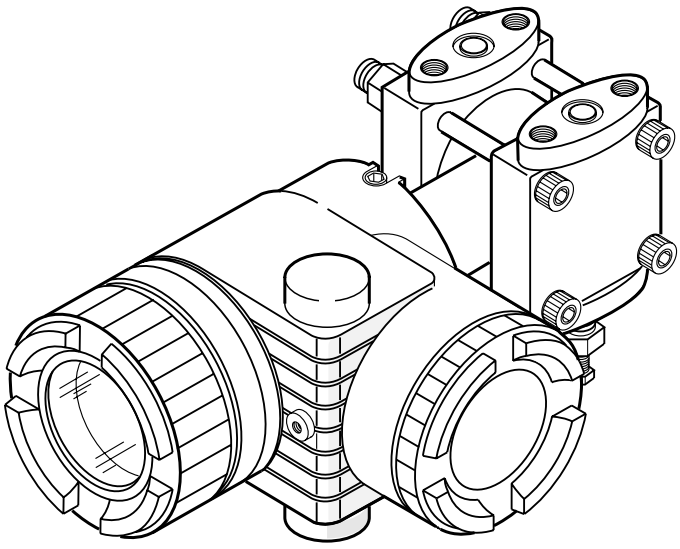
Instruction Manual

FCX-AII SERIES TRANSMITTERS (PROFIBUS-PA Type)

TYPE:				9th
	FDA	FDW	…	R
	FDB	FDX		V
	FDC	FDY		T
	FDD			W
	FDE			
	FDG			



Fuji Electric Systems Co., Ltd.

INF-TN4FCXA2PBa-E

INTRODUCTION

Thank you very much for your purchase of the Fuji FCX-AⅡ Series Transmitters (PROFIBUS-PA Type).

- First read this instruction manual carefully until an adequate understanding is required, and then proceed to installation, operation and maintenance of the FCX-AⅡ Series transmitter.
- The specifications of the transmitter will be changed without prior notice for further product improvement.
- Modification of the transmitter without permission is strictly prohibited. Fuji will not bear any responsibility for a trouble caused by such a modification.
- This instruction manual should be kept by a person who is actually using the transmitter.
- After reading this manual, keep it at a place easier to access.
- This manual should be delivered to the end user without fail.
- For detail specifications and outline diagrams, refer to the specifications furnished separately.

The product conforms to the requirements of "the Electromagnetic compatibility Directive 89/336/EEC" and "Equipment and protective systems intended for use in potentially explosive atmospheres Directive 94/9/EC" as detailed within the technical construction file number TN513035. The applicable standards used to demonstrate compliance are :

EN 61326: 1997 Class A

EN 61326: 1997 Annex A

Manufacturer:	Fuji Electric Instrumentation Co., Ltd.
Type:	Described in nameplate on main frame (see Page iv)
Date of manufacture:	Described in nameplate on main frame
Product nationality:	Japan

© Fuji Electric Sysems Co., Ltd. 2006

Request

- Transcription of a part or the whole of this manual without permission is prohibited.
- The contents of this manual are subject to change without prior notice.

Issued in February, 2006
Rev. 1st edition May, 2007

CAUTION ON SAFETY

First of all, read this “Caution on Safety” to ensure correct operation of the transmitter.

- The cautionary descriptions listed here contain important information about safety, so they should be observed without fail. Those safety precautions are classified into ranks "DANGER" and "CAUTION".

DANGER	Wrong handling may cause a dangerous situation, in which there is a risk of death or heavy injury.
CAUTION	Wrong handling may invite a dangerous situation, in which there is a possibility of medium-level trouble or slight injury or only physical damage is predictable.

On items listed under “ **CAUTION** ”, they may also lead to serious accidents depending on circumstances, and must be fully observed.

- The signs of prohibition and indication are explained in the following.

PROHIBITION	General items which pertain to prohibition (DO NOT)
INDICATION	General items which pertain to user’s action

Installation and Piping

DANGER

- Non-explosion-proof transmitter must not be used in a place with explosive gases to prevent serious accidents such as explosion, fire, etc.

CAUTION

- The transmitter is heavy. Be careful when handling it.
- The transmitter should be installed in a place that meets the operating conditions shown in DS sheet or this instruction manual.
- Install the transmitter according to the instruction manual. Improper installation may lead to the cause of fall, trouble or incorrect operation.
- When installing, make sure that the transmitter interior is free from cable chips and other foreign objects to prevent fire, trouble, or incorrect operation.
- When power is ON, do not change the position of the field indicator in an explosion-proof area.
- When power is ON, do not change the position of the amplifier unit in an explosion-proof area.
- When power is ON, do not change the angle of the indicator.
- Main valve used for piping should be selected with the maximum pressure of the process taken into account (piping parts such as main valve, etc. should be furnished by user). If the main valve and other parts do not meet the rating, it may result in leakage of gas or liquid which could lead to hazard.
- Pressure pipes to be used must meet the temperature/pressure rating.

Wiring

DANGER

- On explosion-proof type transmitter, its wiring work must be performed according to the required laws and regulations. Incorrect wiring may cause explosion, fire or other serious accidents.

CAUTION

- Before making wiring work, be sure to turn OFF the main power to prevent electric shocks.
- Use wiring materials of correct rating to prevent fire accidents.
- Connect a power source of correct rating to prevent fire accidents.
- The transmitter should be grounded as specified to prevent electric shocks or incorrect operation.
- After installing the transmitter, firmly close the covers of the amplifier unit and terminal box. If not, rain water enter the transmitter which may result in trouble or incorrect operation.

Adjustment

DANGER

- When using a flame-proof transmitter, do not connect HHC to the transmitter terminals and junction terminals.

Replacement of Maintenance Parts

DANGER

- When removing an explosion-proof transmitter, turn OFF the main power, then disconnect the piping and wiring. Do not remove it when the power is ON to prevent serious accident such as explosion, fire, etc.

CAUTIONS ON USE

Be sure to observe the following instructions

Storage for a long period

Store the transmitter in a dry room at normal temperature and humidity.
Keep protection caps in place at the conduit connection and process connection.

For installation, select an appropriate place

Site at location with minimal vibration, dust and corrosive gas

At a place allowing an adequate space for checkup

Site at location large enough to allow maintenance and checking.

Mounting angle

Mount to a pipe horizontally or vertically.

Attention to overload

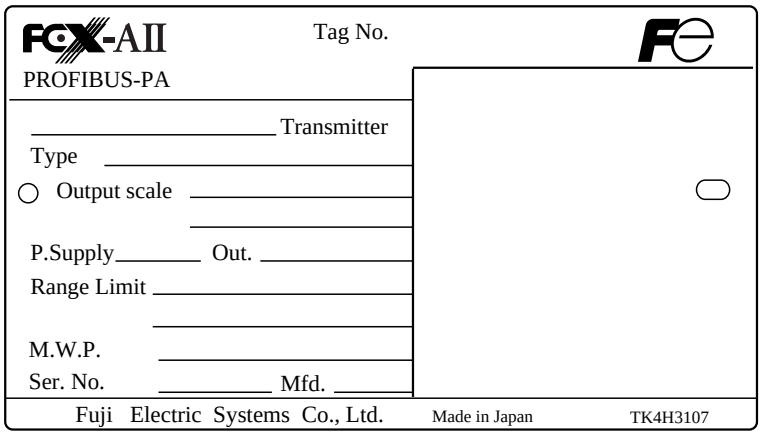
Do not apply a pressure outside the specified range.

Other

Besides the above, be sure to observe the cautions given in this manual.

CONFIRMATION OF YOUR SPECIFICATION

The instrument nameplate as shown below is attached at the amplifier unit of this transmitter. Before use, make sure the contents of the nameplate agree exactly with your specifications.



CONTENTS

INTRODUCTION i
CAUTION ON SAFETY ii
CAUTIONS ON USE iv
CONFIRMATION OF YOUR SPECIFICATION iv
CONTENTS v
1. OUTLINE 1
2. OPERATING PARTS AND THEIR FUNCTIONS 2
3. OPERATION AND SHUTDOWN 4
3.1 Preparation for operation 4
3.2 Operation 5
3.3 Shutdown 6
4. PROFIBUS-PA 8
4.1 Outline 8
4.2 Logical structure of field device 8
4.2.1 Function block VFD 8
4.3 Necessary equipment 10
4.4 Setting the device address 12
4.5 Device database and type file 13
4.6 Block setting 14
4.6.1 View object 14
4.6.2 Parameters of AI function block 18
4.6.3 Parameters of transducer block 19
4.6.4 Parameters of physical block 19
4.6.5 Alarms and events 20
5. ADJUSTMENT AND SETTING 21
5.1 Method of adjustment on host system 21
5.1.1 Zero adjustment on host system 21
5.1.2 Span adjustment on host system 21
5.2 Zero adjustment 22
5.3 How to set the output mode 23
5.4 Setting of low flow cut point 23
5.5 Damping adjustment 23
5.6 Setting of burnout direction 23
5.7 Locking of external adjustment function 24
5.8 Setting of display on digital indicator 24
5.8.1 Setting method 24
5.9 Setting of output scale 25
5.10 Simulation function 25
6. MAINTENANCE 26
6.1 Periodic inspection 26
6.2 Troubleshooting 27
6.3 Replacement of parts 28

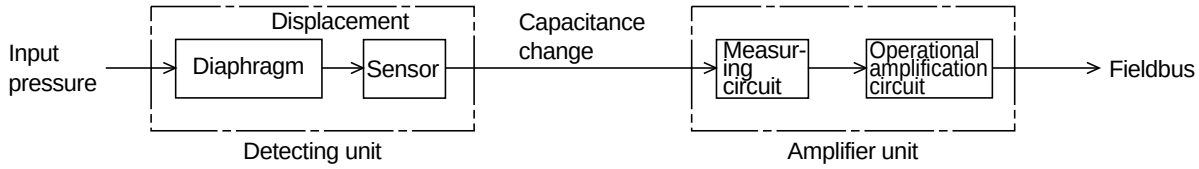
7. INSTALLATION AND PIPING 35
7.1 Installation 35
7.2 Piping 38
7.2.1 Piping of differential pressure and flow transmitter (type: FDC) 38
7.2.2 Piping of pressure and absolute pressure transmitter (types: FDG, FDA) 42
7.2.3 Piping of level transmitter (types: FDE, FDY) 44
7.2.4 Piping of remote seal type differential pressure transmitter (types: FDD, FDX) 47
7.2.5 Piping of remote seal type pressure transmitter (types: FDB, FDW) 50
8. WIRING 54
8.1 Wiring procedure 54
8.2 Configuration of PROFIBUS-PA connection 56
8.3 Grounding 56
Appendix 1 CALIBRATION 57
Appendix 2 PARAMETERS OF BLOCKS 60
Appendix 3 UNIT CODES 62
Appendix 4 HAZARDOUS LOCATION INSTALLATION INFORMATION 63
Appendix 5 DISPLAY UNIT CODES 66
Appendix 6 CABLES FOR H1 FIELDBUS 67

1. OUTLINE

The FCX-AⅡ series transmitter (PROFIBUS-PA type) detects the differential pressure or pressure of various fluids, converts it into a fieldbus signal and transmits it.
Specifications standardized by the PROFIBUS-PA are adopted for the PROFIBUS-PA type of FCX-AⅡ series, whereby an interchangeability with products of our or other companies is ensured.
The AI function block is installed for carrying out differential pressure or pressure calculation.

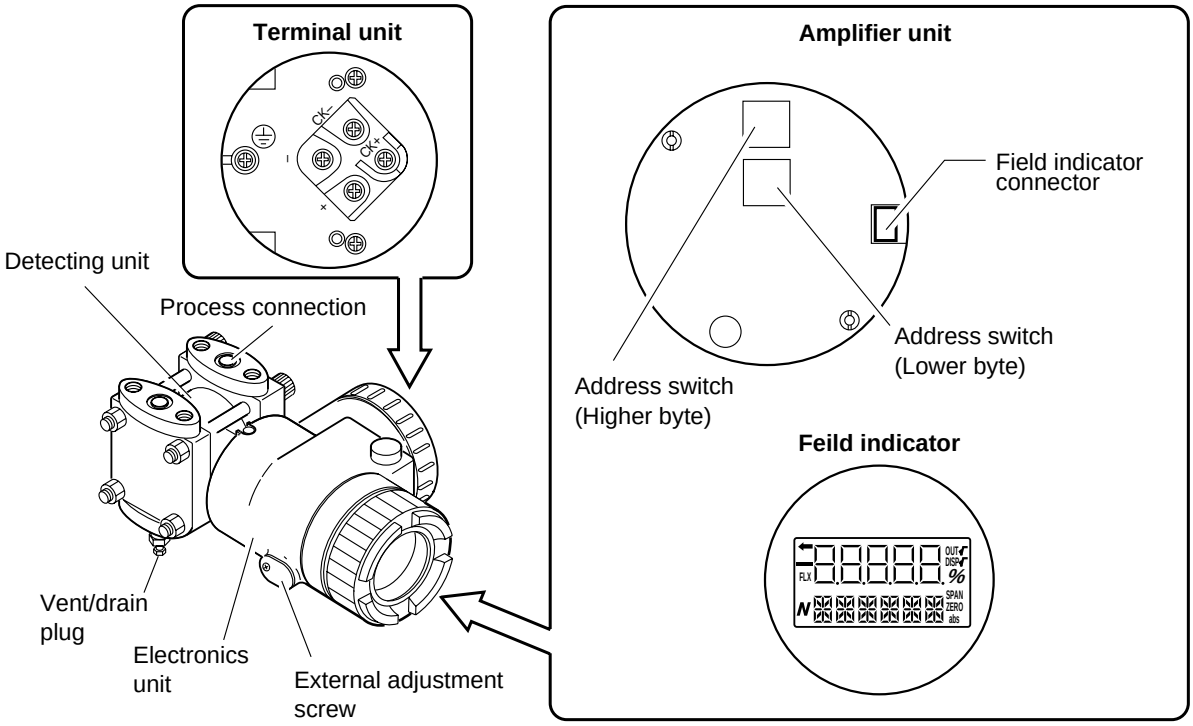
Principle

The operating principle of the FCX-AⅡ series transmitter is shown in the block diagram below. The input pressure is changed into an electrostatic capacitance in the detecting unit. The change proportional to the pressure undergoes amplification and calculation in the transmitting unit, and is then output to the fieldbus.



2. OPERATING PARTS AND THEIR FUNCTIONS

FCX-AⅡ Series transmitter



Description of FCX-AⅡ Series transmitter

Part name	Description
Detecting unit	Detects pressure, differential pressure or level of fluid.
Amplifier unit	Converts the detected signal into an output signal.
Vent/drain plug	Used for gas discharge or draining. (Attention should be paid under a high pressure.)
Process connection	Connects impulse pipes from the process.
Conduit connection	Connects the output cable.
External adjustment screw	Adjusts zero.
Terminal box	Used for connecting input/output cable and grounding cable.

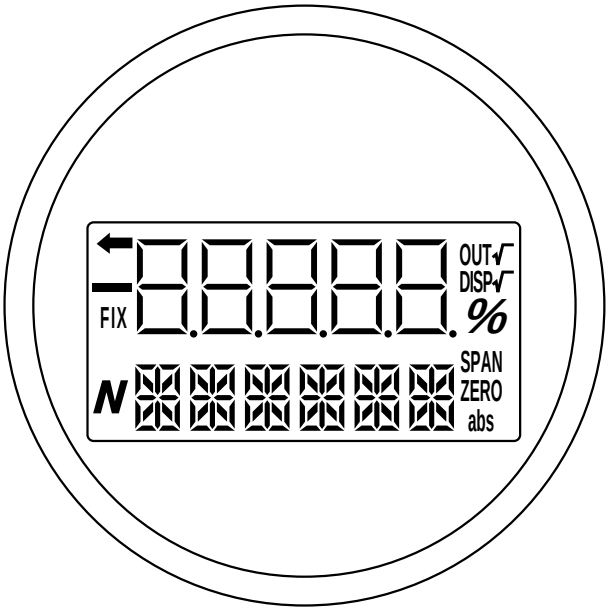
Amplifier unit

Part name	Description
Field indicator connector	Used for connecting the field indicator.
Field indicator (option)	A digital field indicator can be mounted.
Address switch	Used for setting the node address.

Terminals

Symbol	Description
+, –	Connects the cable to the fieldbus.
CK+, CK–	Not used for the PROFIBUS-PA type.
⏚	Used for grounding within the terminals.

Mode and status indicating functions for field indicator



Mode and status indications

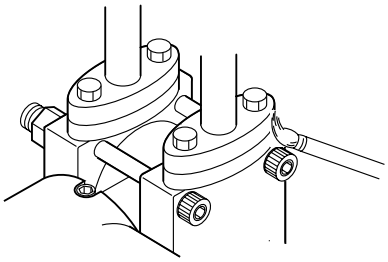
Mode	When indicated	When not indicated
%	% output (unused)	Actual scale
ZERO	External zero adjustment possible	External zero adjustment impossible
DISP √‾	Field indicator √‾ display	Field indicator LIN display
⬅	Transmitter operating (Flicker)	Transmitter not operating
abs	Absolute pressure	Gage pressure
–	Output value < Zero	Output value ≧ Zero
N	(Display at particular unit selection)	
FIX	Simulation active	Simulation inactive

3. OPERATION AND SHUTDOWN

3.1 Preparation for operation

Before operating the transmitter, be sure to perform the following checks and procedures. On zero point check or zero adjustment in hazardous area, do not open terminal cover.
Use the transmitter indicator and the external adjustment screw.

Preparation procedure



(1) Check for liquid or gas leakage from the process connection, etc. by applying soapy water or the like.

(2) Check the signal wiring according to the "Terminal block connection diagram" shown in 8.1.

(3) Vent gas from the transmitter in the case of liquid measurement.

Important

When the plant requires chemical cleaning at the start of operation, be sure to close the valve of the transmitter to prevent entry of cleaning liquid into the pressure receiving unit.

(4) Perform zero point adjustment.

Zero point adjustment

Turn on the fieldbus.
Watch the host system for checking the output signal of the transmitter.
After ten minutes or longer, adjust the transmitter output to zero in the following manner.

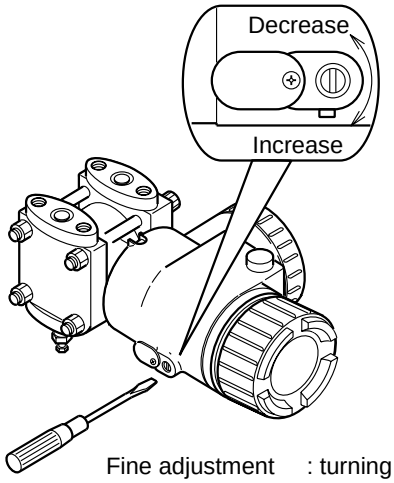
Zero adjustment

(1) Adjustment by zero adjustment screw

Adjust zero point of the transmitter to a specified zero point output by turning the zero adjustment screw.

(2) Adjustment by host instrument

Refer to "zero and span adjustment" on the host system in 5.1.



Fine adjustment : turning slowly
Rough adjustment : turning quickly

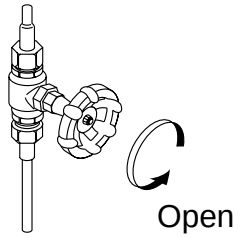
Important

1. After adjustment of the transmitter, it should be kept energized for about 10 seconds to write the adjustment results into memory.
2. Use a blade-edge screwdriver for adjusting the zero adjustment screw.

3.2 Operation

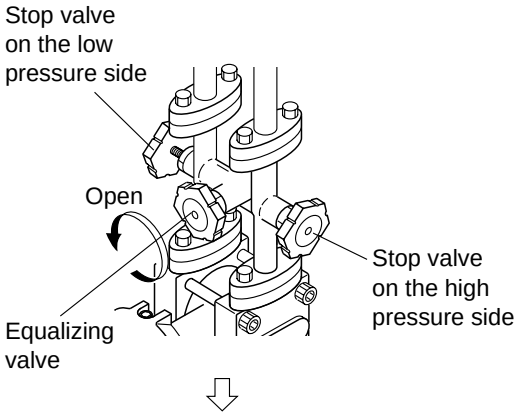
(1) Operation of pressure transmitter

Open the valve slowly to apply a pressure. When a pressure is applied, the transmitter is set in the operating status.

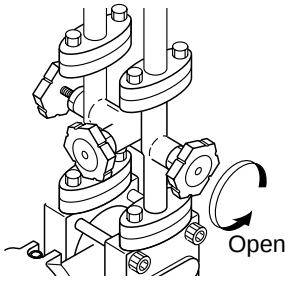


(2) Operation of differential pressure transmitter

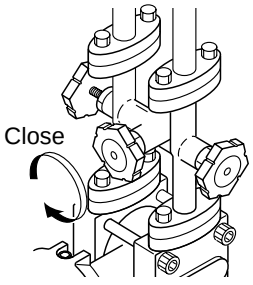
Set the operating status by manipulating the manifold valve.



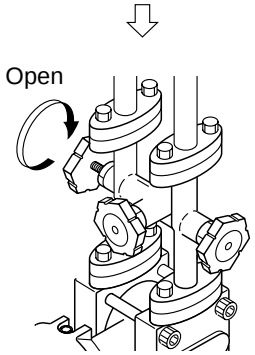
Make sure the equalizing valve is open.



Open the stop valve on the high pressure side slowly.



Close the equalizing valve.



Finally, open the stop valve on the low pressure side slowly.

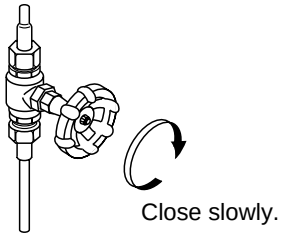
Check of operating status

Use a field indicator, or host instrument to check the operating status.

3.3 Shutdown

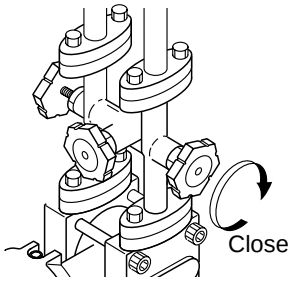
(1) Shutdown of pressure transmitter

Close the valve slowly to stop applying a pressure. The transmitter is set in the measurement stop status.

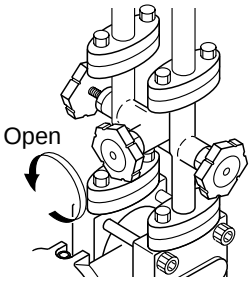


(2) Shutdown of differential pressure transmitter

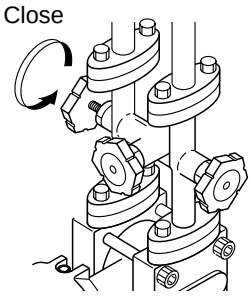
Set the shutdown status by manipulating the manifold valve.



Close the stop valve on the high pressure side (H side) slowly.



Open the equalizing valve.



Close the stop valve on the low pressure side (L side) slowly.

Important

Before a long shutdown, discharge the process fluid and drain completely from the transmitter.
This is to protect the transmitter from freezing, corrosion, etc.

4. PROFIBUS-PA

4.1 Outline

The fieldbus type is a bidirectional digital communication method for field devices adopted instead of the conventional analog communication of 4 to 20 mA.
Specification standardized by the PROFIBUS-PA are adopted for the PROFIBUS-PA type of FCX-AⅡ series, whereby an interchangeability with fieldbus products of our or other companies is ensured.
One AI function block is installed for different pressure or pressure calculation.

4.2 Logical structure of field device

In the PROFIBUS-PA version, one virtual field device (VFD) exist, having the function given below.

4.2.1 Function block VFD

(1) Physical block
- Managed the hardware statuses.

(2) Transducer block
- Converts the sensor output into a pressure signal, and transmits it to the AI function block.

(3) AI function block

The function block of the PROFIBUS-PA version is a function model common to measurement and control.
The FCX-AⅡ series is equipped with an analog input (AI) function block. This block receives data measured by the transducer block, and subjects the data to the following processing.
- Scaling
- Damping
- Alarm generation

Fig. 4-1 shows the internal configuration of the AI function block.

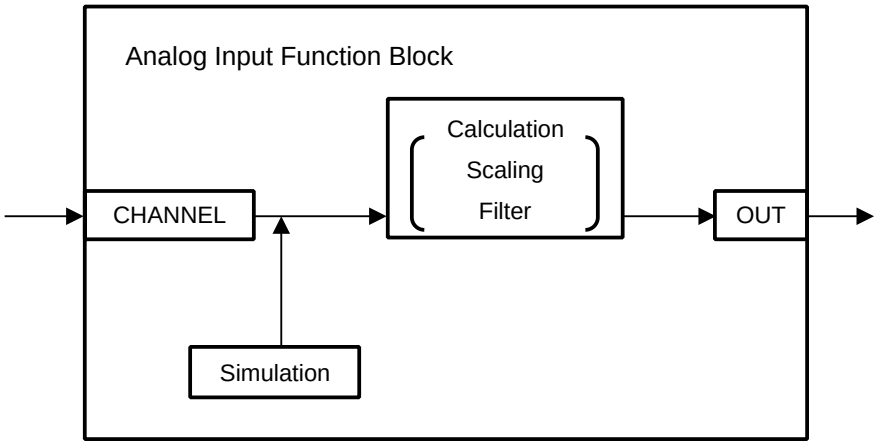


Fig. 4-1 AI function block

Logical structure of field device

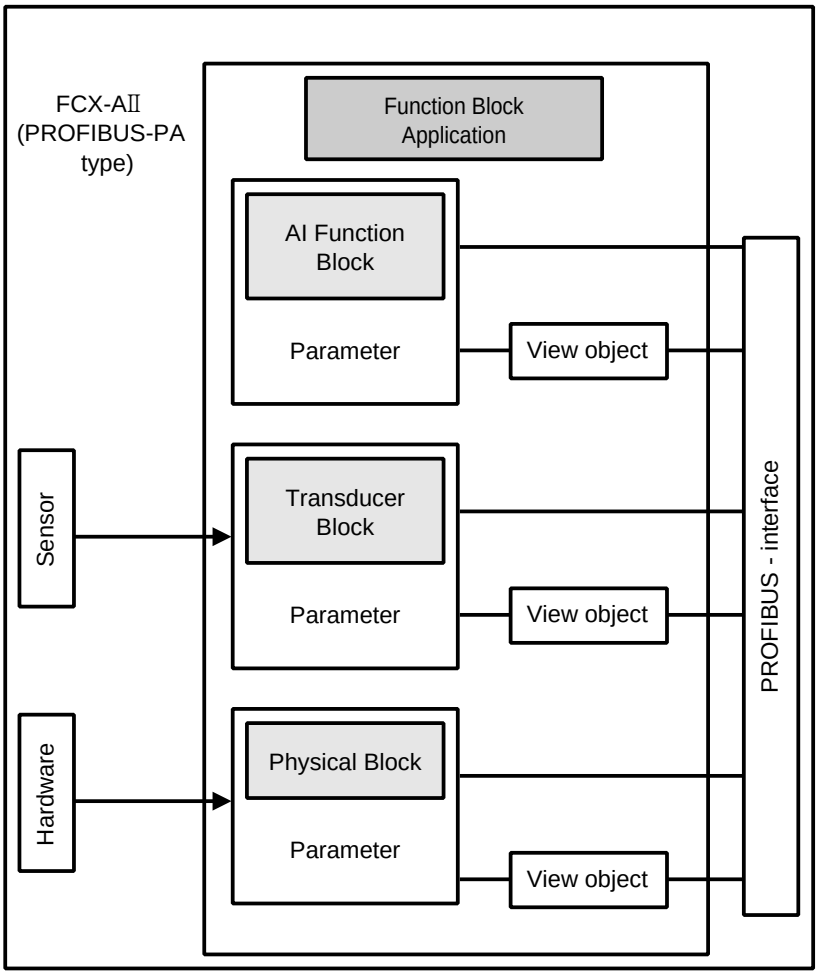


Fig. 4-2 Logical structure of field device

4.3 Necessary equipment

In order that a device of PROFIBUS-PA type can be used, the following equipment are required.

- Segment coupler/Link
  Segment coupler is signal converter that modulate the RS485 signals(PROFIBUS-DP) to the PROFIBUS-PA signals level.
  In contrast, the link has the own intrinsic intelligence. The link map all the field devices connected to the PROFIBUS-PA segment as a single slave in PROFIBUS-DP segment. There is no limit to the transmission rate to the PROFIBUS-DP segment when using link, so that fast networks can also be implemented using field devices with PROFIBUS-PA connection.

- Terminator
  The terminator dedicated to the fieldbus is required. On H1 fieldbus, a terminator with 100Ω and 5μF connected in series is used on each of its end. The segment coupler side may incorporate one. Contact the supplier you purchased the segment coupler from.

- Host system
  Used for measurement and control of the field device. For details, refer to the instruction manual of host system manufacturer.

- Engineering tool and HMI
  Used for configuration of the field device. For details, refer to the instruction manual of engineering tool and HMI manufacturer.

- Cables (PROFIBUS-PA)
  Used for connecting the devices. As instrumentation cable, we recommend you to use type A cable of the H1 fieldbus. For the cable specifications, refer to Appendix 6 “CABLES FOR H1 FIELDBUS”.

- Cables and Connectors (PROFIBUS-DP)
  Different cable type for different applications are available on market for connecting devices either to each other or to network elements (segment couplers,links,etc).
  When using RS485 transmission technology, Profibus International recommends the use of cable type A.
  A 9-pin D-Sub connector is primarily used for protection rating IP20. For IP65/67 there are three common altematives.
  - M12 circular connector in accordance with IEC947-5-2
  - Han-Brid connector in accordance with DESINA recommendation
  - Siemens hybrid connector

Transmission Rate [Kbit/s]	Range per segment [m]
9.6, 19.2, 45.45, 93.75	1200
187.5	1000
500	400
1500	200
3000, 6000, 12000	100

Transmission rate and range for cable type A

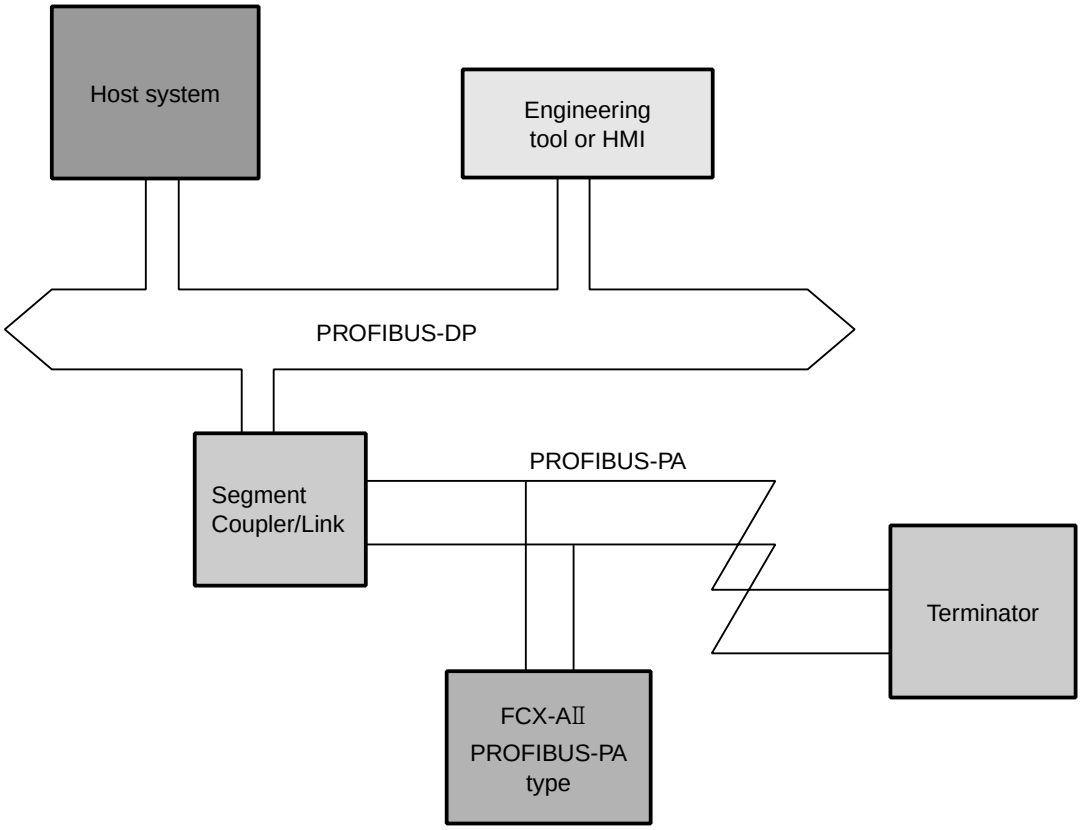


Fig. 4-3 Connection of equipments

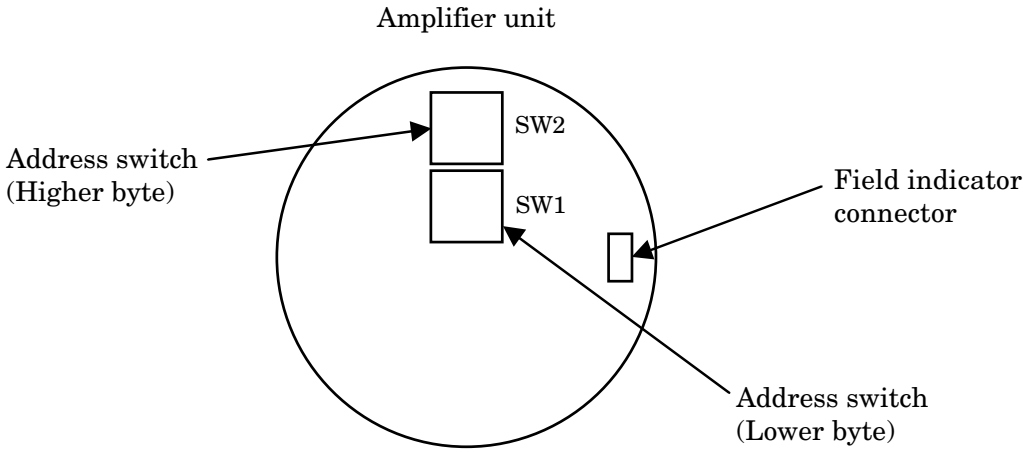
4.4 Setting the device address

Every PROFIBUS-PA device must be given an address. If the address is not set correctly, the device will not be recognized by the process control system.

- Valid device address are in the range 0 and 125.
- One device address is given only to one of the PROFIBUS-PA networks.

There are two methods to set the address of the FCX-AⅡ :

- Remotely by using an operating program,e.g. SIMATIC PDM
- Locally at the device Address switches that are to be found behind the display.



Example:

Address switch of SW1 set to A. Address switch of SW2 set to 0.

The device address is 10.

SW1 : Lower byte of device address

SW2 : Higher byte of device address

Remote addressing mode

Set the remote addressing mode at SW1, SW2:

SW1 = F, SW2 = 7 (127) or SW1 = E, SW2 = 7 (126) : software addressing via the bus system

Others: hardware addressing at the device via Address switches

4.5 Device database and type file

A device database (GSD) contains description of the properties of the PROFIBUS-PA device, e.g. supported transmission rate and the type and format of the digital information output to the host system. The bitmap file also belong to the GSD files. The device database file and corresponding bitmaps are required by the network design tool of the PROFIBUS-DP network.

Every device is allocated an identity code the PROFIBUS User Organisation (PNO). This appears in the device data base file name (.gsd). For Fuji Electric Systems devices, the identity code is always 0Axx, where xx is device dependent.

Name of device	ID No.	Data base file	Bitmap
FCX-AⅡ	0A02(hex)	F15E0A02.gsd	FCX_A2.bmp

4.6 Block setting

4.6.1 View object

Used for accessing data upon grouping the block parameters. 4 view objects each are supported by the FCX-AⅡ for physical block, transducer block and function block as given in Tables 4-6 to 4-8. Values in the tables denote byte counts of each parameter.

Table 4-6 View object of physical block

Relative index	Parameter name	VIEW1	VIEW2	VIEW3	VIEW4
1	ST_REV	2			
2	TAG_DESC				
3	STRATEGY				
4	ALERT_KEY				
5	TARGET_MODE				
6	MODE_BLK	3			
7	ALARM_SUM	8			
8	SOFTWARE_REVISION				
9	HARDWARE_REVISION				
10	DEVICE_MAN_ID				
11	DEVICE_ID				
12	DEVICE_SER_Num				
13	DIAGNOSIS	4			
14	DIAGNOSIS_EXTENSION				
15	DIAGNOSIS_MASK				
16	DIAGNOSIS_MASK_EXTENSION				
17	DEVICE_CERTIFICATION				
18	WRITE_LOCKING				
19	FACTORY_RESET				
20	DESCRIPTOR				
21	DEVICE_MESSAGE				
22	DEVICE_INSTALL_DATE				
23	LOCAL_OP_ENA				
24	IDENT_NUMBER_SELECTOR				
25	HW_WRITE_PROTECTION				
26 - 32					
33	ERR_COUNT				
34	RESET_ERR_COUNT				
35	W_PROTECT				

Table 4-7 View object of transducer block (1/2)

Relative index	Parameter name	VIEW1	VIEW2	VIEW3	VIEW4
1	ST_REV	2			
2	TAG_DESC				
3	STRATEGY				
4	ALERT_KEY				
5	TARGET_MODE				
6	MODE_BLK	3			
7	ALARM_SUM	8			
8	SENSOR_VALUE				
9	SENSOR_HI_LIM				
10	SENSOR_LO_LIM				
11	CAL_POINT_HI				
12	CAL_POINT_LO				
13	CAL_MIN_SPAN				
14	SENSOR_UNIT				
15	TRIMMED_VALUE				
16	SENSOR_TYPE				
17	SENSOR_SERIAL_NUMBER				
18	PRIMARY_VALUE	5			
19	PRIMARY_VALUE_UNIT				
20	PRIMARY_VALUE_TYPE				
21	SENSOR_DIAPHRAGM_MATERIAL				
22	SENSOR_FILL_FLUID				
23	SENSOR_MAX_STATIC_PRESSURE				
24	SENSOR_O_RING_MATERIAL				
25	PROCESS_CONNECTION_TYPE				
26	PROCESS_CONNECTION_MATERIAL				
27	TEMPERATURE				
28	TEMPERATURE_UNIT				
29	SECONDARY_VALUE_1				
30	SECONDARY_VALUE_1_UNIT				
31	SECONDARY_VALUE_2				
32	SECONDARY_VALUE_2_UNIT				
33	LIN_TYPE				
34	SCALE_IN				
35	SCALE_OUT				
36	LOW_FLOW_CUT_OFF				
37	FLOW_LIN_SQRT_POINT				
38	TAB_ACTUAL_NUMBER				
39	TAB_ENTRY				
40	TAB_MAX_NUMBER				
41	TAB_MIN_NUMBER				
42	TAB_OP_CODE				
43	TAB_STATUS				
44	TAB_X_Y_VALUE				
45	MAX_SENSOR_VALUE				

Table 4-7 View object of transducer block (2/2)

Relative index	Parameter name	VIEW1	VIEW2	VIEW3	VIEW4
46	MIN_SENSOR_VALUE				
47	MAX_TEMPERATURE				
48	MIN_TEMPERATURE				
49 - 58	reserved by PNO				
59	BURNOUT_SET				
60	PV_SENSOR_INF				
61	OUTPUT_INF				
62	CAL_DATA				
63	CAL_UPPER				
64	CAL_LOWER				
65	DYNAMIC_INFO				
66	LOCAL_KEY				
67	CELL_BODY_NUMBER				
68	LCD_COMMAND				
69	LCD_DISP				
70	LCD_SEG_DATA				
71	MEM_COMMAND				
72	MEM_ACCESS				

Table 4-8 View object of function block

Relative index	Parameter name	VIEW1	VIEW2	VIEW3	VIEW4
1	ST_REV	2			
2	TAG_DESC				
3	STRATEGY				
4	ALERT_KEY				
5	TARGET_MODE				
6	MODE_BLK	3			
7	ALARM_SUM	8			
8	BATCH				
10	OUT	5			
11	PV_SCALE				
12	OUT_SCALE				
13	LIN_TYPE				
14	CHANNEL				
16	PV_FTIME				
17	FSAFE_TYPE				
18	FSAFE_VALUE				
19	ALARM_HYS				
21	HI_HI_LIM				
23	HI_LIM				
25	LO_LIM				
27	LO_LO_LIM				
30	HI_HI_ALM				
31	HI_ALM				
32	LO_ALM				
33	LO_LO_ALM				
34	SIMULATE				
35	OUT_UNIT_TEXT				

4.6.2 Parameters of AI function block

Settings of parameters of the AI function block can be read, and they can be set on the host system. For main block parameters supported by the FCX-AII, refer to Appendix 2 "PARAMETERS OF BLOCKS". Here, important parameters will be explained.

TARGET_MODE

Determines the mode of the AI function block.

TARGET_MODE is a parameter by which the operator sets the operation mode of the AI function block. This parameter can be written.

MODE_BLK

Display the mode of AI function block.

This parameter consists of 3 elements: Actual, Permitted, Normal.

Actual indicates the actual operation mode of the block, and is used for read only. If requirements were met, Actual works the same as TARGET_MODE. Actual may differ from Target for several reasons.

Permitted indicates which mode is allowed in this function block. Normal is an element by which the operator sets a mode where this function block operates normally. Permitted and Normal are elements where writing is available.

On the AI function block, Out of Service, Manual or Auto is selectable. In the Out of Service mode, the AI function block carries out no execution. In the Manual mode, the AI function block carries out an execution, but last value is not affected by its output and remains as it is. The output can be rewritten from the host instrument. In the Auto mode, the AI function block carries out an execution, and updates the output. This is a normal measurement mode.

PV_SCALE

Used for setting values corresponding to 0% and 100% of the input from the transducer block and industrial value unit. A calibrated range is set prior to delivery. The unit is determined by the PRIMARY_VALUE_UNIT of transducer block.

OUT_SCALE

Used for setting values corresponding to 0% and 100% of the output, and industrial value unit.

PV_FTIME

Used for setting a damping time constant in seconds. Select a value 0 or more.

HI_HI_LIM,HI_LIM,LO_LIM,LO_LO_LIM

Used for setting threshold values at which process alarms will occur. Settings prior to delivery are positive infinity and negative infinity so that no alarms will occur.

4.6.3 Parameters of transducer block

The transducer block has parameters peculiar to differential pressure and pressure measurements. For main block parameters available by the FCX-AⅡ, refer to Appendix 2 “PARAMETERS OF BLOCKS”. Here, important parameters will be explained.

CAL_POINT_HI

The high limit (100%) of the calibrated point is set.

CAL_POINT_LO

The low limit (0%) of the calibrated point is set.

CAL_DATA

Used for a calibration. For a calibration with CAL_POINT_LO, select Calibration enable and Low Trim. Or, for a calibration with CAL_POINT_HI, select Calibration enable and Upper Trim. Or, for adjustment with industrial value of 0, select Calibration enable and Zero Calibration.

4.6.4 Parameters of physical block

The physical block has parameters related to the resources of the device. For main block parameters available by the FCX-AⅡ, refer to Appendix 2 “PARAMETERS OF BLOCKS”. Here, important parameters will be explained.

ERROR_COUNT

Errors produced at device communications are counted.

RESET_ERR_COUNT

Used to clear ERROR_COUNT.

W_PROTECT

Controls rewriting parameters peculiar to the FCX-AⅡ. Rewriting is unavailable if True is selected, or available if False is selected.

4.6.5 Alarms and events

The FCX-AⅡ can report the following alarms and events.

Analog alarm: Produced when a process variable has exceeded a limit.
It occurs if the variable is beyond any of HI_HI_LIM, HI_LIM, LO_LIM, LO_LO_LIM of the AI function block.

Discrete alarm: Produced when the AI function block have detected an anomaly.

Alarm_sum	Produced when:
Device fault	The sensor has become abnormal or the internal circuit has troubled.
Input failure	The process input has become abnormal.

5. ADJUSTMENT AND SETTING

5.1 Method of adjustment on host system

The transmitter can be adjusted on the host system upon setting the block parameters.

5.1.1 Zero adjustment on host system

Zero adjustment is available while an input is being applied.

(1) How to set a calibration point (adjustment input)
The adjustment input (calibration point) is set as follows. Set the CAL_POINT_LO to an adjustment input value in the unit displayed at CAL_UNIT.

(2) Set W_PROTECT of the resource block to False (0x00) to allow Fuji's original parameter to be written.

(3) Set Command of CAL_DATA of the transducer block to Low_Trim and Calibration enabled (0x82), and write the parameter setting. Then, an adjustment will be executed at an adjustment input.

(4) After the end of adjustment, set W_PROTECT of the resource block to True (0xff) to protect the original parameter setting from being changed.

5.1.2 Span adjustment on host system

Span adjustment is available while an input is being applied.

(1) How to set a calibration point (adjustment input)
The adjustment input (calibration point) is set as follows. Set the CAL_POINT_HI to an adjustment input value in the unit displayed at CAL_UNIT.

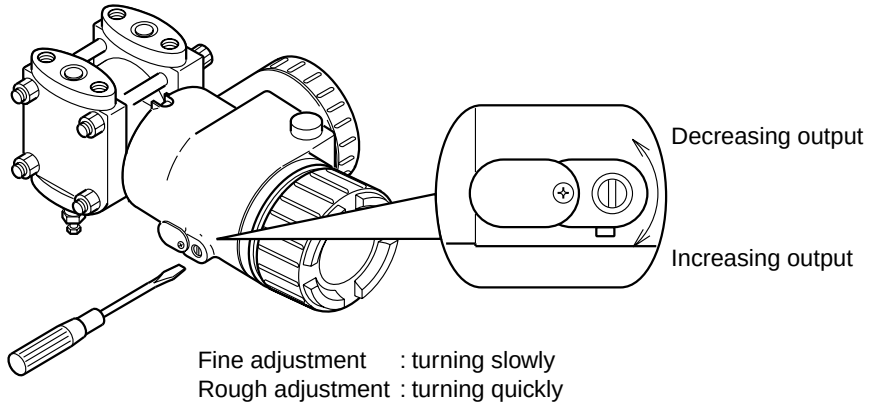
(2) Set W_PROTECT of the resource block to False (0x00) to allow Fuji's original parameter to be written.

(3) Set Command of CAL_DATA of the transducer block to Upper_Trim and Calibration enabled (0x84), and write the parameter setting. Then, an adjustment will be executed at an adjustment input.

(4) After the end of adjustment, set W_PROTECT of the resource block to True (0xff) to protect the original parameter setting from being changed.

5.2 Zero adjustment

Zero adjustment is available by means of the screw (see the figure below) located on the transmitter. (The span adjustment is carried out on the host system or HHC.)



Fine adjustment : turning slowly
Rough adjustment : turning quickly

Important

- After adjustment, the transmitter should be kept energized at about 10 seconds to write the adjustment result correctly.
- An external adjustment on the transmitter is unavailable if the adjustment function is locked (see Item 5.7).

5.3 How to set the output mode

On the differential pressure transmitter, the output signal is set to the proportional mode (proportional to input differential pressure) or square root mode (proportional to flow rate).
Set the LIN_TYPE of the transducer block to:
Indirect (0) for proportional mode of output; or
Indirect Sq. Root (10) for square root mode of output.

5.4 Setting of low flow cut point

If the square root extraction mode was selected for output, the flow rate below which the output is cut should be set in the unit of the output scale (SCALE_OUT) because it is based on the output scale. Set the LOW_FLOW_CUT_OFF of the transducer block to a cut point. A flow rate below the cut point will give 0% output.

5.5 Damping adjustment

If the process variable changes excessively, if the mounting place vibrates excessively, or if the measurement output of a very low differential pressure, for example, varies considerably, selecting an appropriate damping time constant is effective for suppressing the output variation. For this purpose, set the PV_FTIME of the AI function block to a desired time constant.

5.6 Setting of burnout direction

For how to treat the output in case of troubles, etc. of the detection unit, you can select the burnout direction.

(1) Set the W_PROTECT of the resource block to False (0x00) to allow Fuji's original parameter to be written.
(2) Set the BURNOUT_SET of the transducer block to a desired burnout direction as follows.
High (0x00) so that output will stick to high limit
Low (0x01) so that output will stick to low limit
Hold (0xef) so that last output will be held
(3) Set the W_PROTECT of the resource block to True (0xff) to protect Fuji's original parameter setting from being changed.

5.7 Locking of external adjustment function

You can enable/disable the function of adjustment by the external adjustment screw.

(1) Set the W_PROTECT of the resource block to False (0x00) to allow Fuji's original parameter to be written.
(2) Set the LOCAL_KEY of the transducer block to:
Disable (0x01) to lock; or
Enable (0x00) to unlock.
(3) Set the W_PROTECT of the resource block to True (0xff) to protect Fuji's original parameter setting from being changed.

5.8 Setting of display on digital indicator

You can change the indication scale and unit on the digital indicator, if provided, upon selecting the LCD_DISP of the transducer block.

The LCD_DISP has following parameters.

(1) LCD_UPPER_DISPLAY_VALUE: Set to upper limit of display scale
(2) LCD_LOWER_DISPLAY_VALUE: Set to lower limit of display scale
(3) LCD_DIGIT: Set to number of digits below decimal point
(4) LCD_UNIT: Set to unit code
(5) LCD_OPTION: Unused

5.8.1 Setting method

(1) Allowing Fuji's original parameter to be written
Set the W_PROTECT of the resource block to False (0x00) to allow Fuji's original parameter to be written.
(2) Selecting LCD_DISP parameter
To set the LCD_UPPER_DISPLAY_VALUE, input the value of Upper_sensor_limit (PV_SENSOR_INFO) that was converted in terms of setting unit.
To set the LCD_LOWER_DISPLAY_VALUE, input the value of Lower_sensor_limit (PV_SENSOR_INFO) that was converted in terms of setting unit (input 0).
To set the LCD_DIGIT, input the number of digits displayed below decimal point.
To set the LCD_UNIT, input a unit code from the separate table.

[Example of setting]

For measurement at transmitter range of 32 kPa in setting unit of mmH_2O
LCD_UPPER_DISPLAY_VALUE = $32 \times 0.980665 \times 10^2 = 3138.12$ (mmH_2O)
LCD_LOWER_DISPLAY_VALUE = 0 (mmH_2O)
LCD_DIGIT = 0 (0 digit below point)
LCD_UNIT = 262145 (unit code for mmH_2O)

(3) Writing LCD_DISP parameter
Write PARAM_WRITE in the LCD_COMMAND, and write data of LCD_DISP parameter.
(4) Protecting Fuji's original parameter setting from being changed
Set the W_PROTECT of the resource block to True (0xff) to protect Fuji's original parameter setting from being changed.

5.9 Setting of output scale

Setting the output scale determines the scale of the output (OUT) of the AI function block.
For changing the setting, rewrite the data of PV_SCALE and OUT_SCALE of the AI function block.

(1) Set the PV_SCALE of the AI function block to the output scale (based on transducer output unit).
EU at 100: Set the high limit of output based on the output unit of the transducer block.
EU at 0: Set the low limit of output based on the output unit of the transducer block.
(2) Set the OUT_SCALE of the AI function block to the output scale.
EU at 100: Set to the value set at EU at 100 of PV_SCALE in terms of output unit.
EU at 0: Set to the value set at EU at 0 of PV_SCALE in terms of output unit.
UNIT: Set to the unit of the output scale.

5.10 Simulation function

Upon setting the SIMULATE parameters of the AI function block as follows, the arithmetic operation starts with a simulation input.
SIMULATE_VALUE: Set to a simulation input value based on the output unit of the transducer block.
SIMULATE_ENABLE/DISABLE: Set to ENABLE.

6. MAINTENANCE

6.1 Periodic inspection

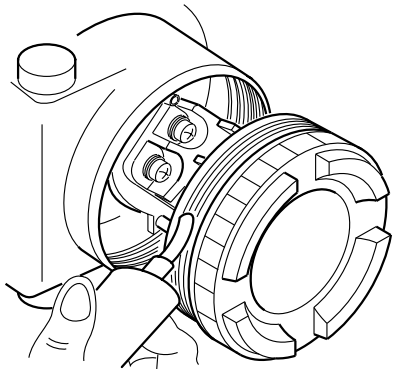
In order to ensure the measurement accuracy and long life of the transmitter, it is essential to inspect the transmitter periodically according to the operating conditions.

Visual inspection

Visually inspect each part of the transmitter for damage, corrosion, etc.
If you detect any material which may cause corrosion, it should be cleaned off.

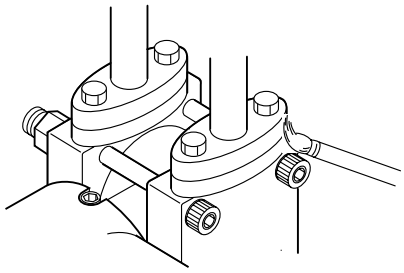
Check of cover and O-ring

The transmitter has a water and dust-proof construction.
Make sure the O-ring of the case cover is not damaged or deteriorated.
Carefully prevent foreign materials from sticking to threads.
Before remounting the transmitting cover and the terminal cover, apply grease.



Piping leakage check

Using soapy water or the like, check the all process connections for leakage of process fluid. If necessary, drain the moisture which has accumulated in the transmitter and process pipe.



6.2 Troubleshooting

If an abnormality occurred in the process or transmitter, action should be taken with reference to the table below.

Symptom	Cause	Remedy
Output overshoots scale.	(1) The manifold valve does not open/close normally.	Repair the valve so that it opens/closes normally.
	(2) Pressure leak is occurring.	Repair a leak.
	(3) Process piping is improper.	Make correct piping.
	(4) Process pipe is clogged.	Eliminate the cause of clogging.
	(5) Power supply voltage is improper.	Make arrangement to obtain proper values.
	(6) Voltage between the external connection terminals of amplifier unit is wrong.	Check for faulty cable, insulation, etc. and repair as needed. (Power supply voltage should be 9 to 32V DC.)
	(7) Electronics unit is faulty.	Replace the electronics unit according to Item 6.3.
No output	(1) Same as (1) to (4) above	
	(2) Power supply polarity is wrong.	Correct wiring according to Item 8.1.
	(3) Power supply voltage is improper.	Make arrangement to obtain proper value.
	(4) Voltage between the external connection terminals is wrong.	Check for faulty cable, insulation, etc. and repair as needed. (Power supply voltage should be 9 to 32V DC.)
	(5) Electronics unit is faulty.	Replace the electronics unit according to Item 6.3.
Output is large error	(1) Process piping is improper.	Correct the piping.
	(2) Gas or solution is mixed in.	Vent or drain the transmitter.
	(3) Liquid density changes.	Perform density compensation.
	(4) Ambient temperature changes widely.	Minimize the temperature change.
	(5) Electronics unit is faulty.	Replace the electronics unit according to Item 6.3.

If remedy is impossible, contact Fuji Electric's service department.

6.3 Replacement of parts

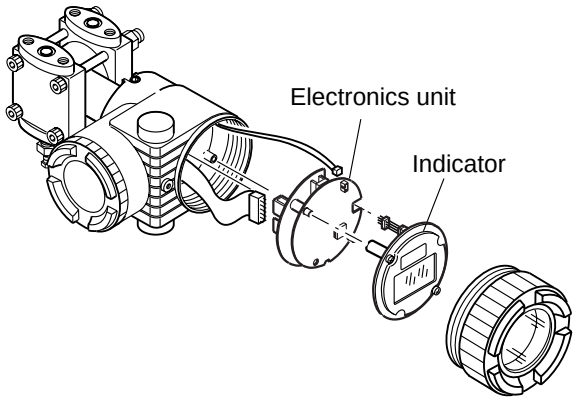
If malfunction occurs to the transmitter, remove the transmitter from the piping, and replace defective parts or the unit. It is desirable that the replacement work be done within an instrument adjustment room.

⚠ **DANGER**	When removing an explosion-proof transmitter, turn OFF the main power, then disconnect the piping and wiring. Do not remove it when the power is ON to prevent serious accident such as explosion, fire, etc.

To identify faulty part

Replace the amplifier unit with a spare one in order to determine whether it is the detecting unit or amplifier unit which is faulty.
When the faulty unit is identified, it should be replaced with a new one.

Replacement of electronics unit

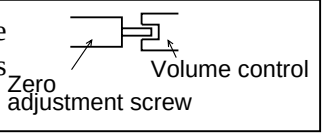


Replacing procedure

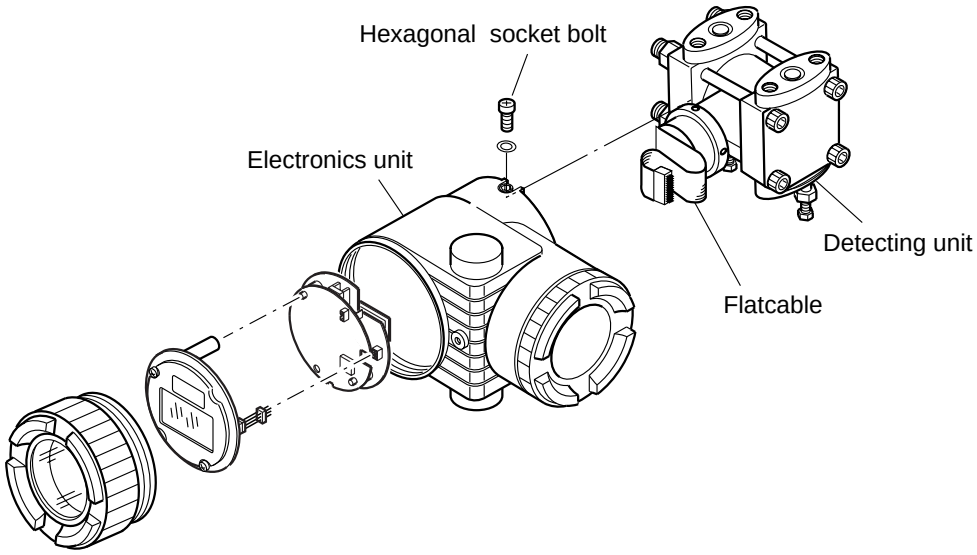
(1) Turn off the power supply.
(2) Remove the indicator.
(3) Remove the electronics unit.
(4) Unplug each connector.
(5) Replace the electronics unit with a new one and assemble it by reversing the above procedure from (4) to (1).

Important	The electronics unit should be removed carefully so as not to damage the internal wiring.

(6) After completion of replacement, perform zero and span adjustments.

Important	When installing the electronics unit, make sure that the zero adjust screw and the volume control are positioned as shown the right. 

Replacement of detecting unit



Replacing procedure

(1) Remove the electronics unit according to “Replacement of electronics unit.”

(2) Remove the hex. socket bolts from the electronic housing.
Pull the electronics housing straight forward and away from the detecting unit.

(3) Replace the detecting unit with a new one of the same type.

(4) Fit the amplifier unit to the detecting unit and tighten it.

(5) Connect each connector of the electronics unit and attach it to the amplifier unit.

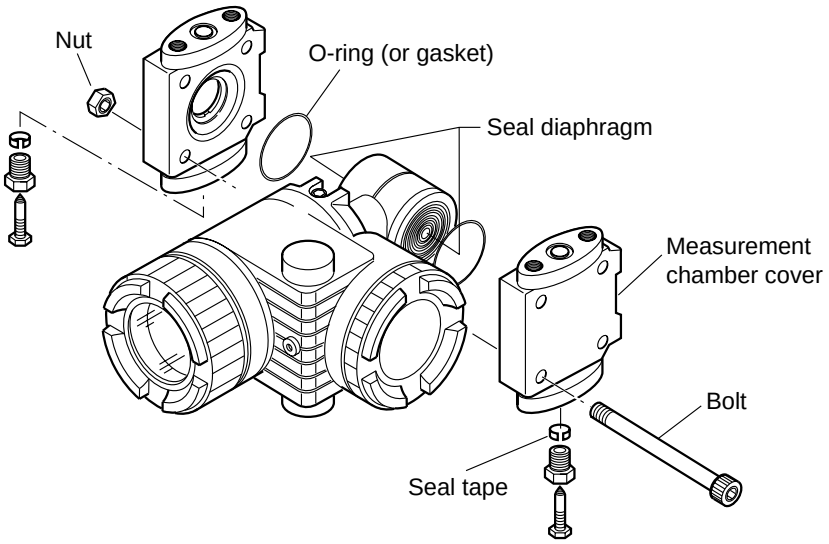
(6) After reassembly, carry out zero and span adjustments.

Important

- Ensure that replacement detecting unit is the same specification as the original by comparing dataplates.
- When removing the transmitter case, pay attention not to damage the flatcable.

Replacement of the internal parts of detecting unit

In case of differential and flow transmitter (code symbol: FDC)



Replacing procedure

(1) Remove four hexagon socket head bolts with a torque wrench, etc..

(2) Disassembly gives access to the casing covers, O-rings (or gasket), hexagon socket head bolts and nuts.

(3) After disassembly, replace the faulty part with a new one.

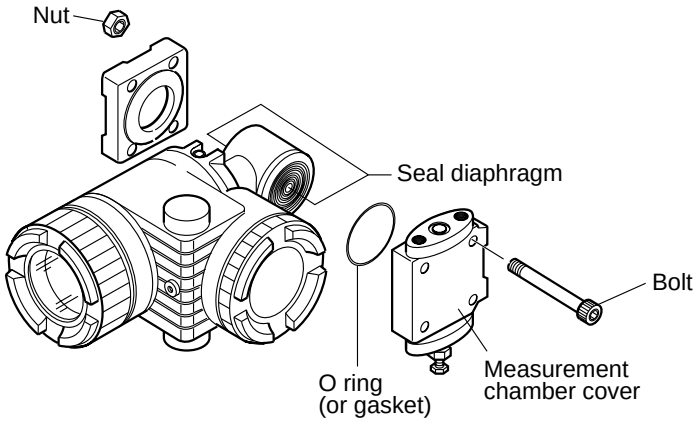
(4) Before reassembly, clean the O-ring face of casing cover with the soft cloth immersed in water, alcohol, or similar detergent.

(5) Reassemble the detecting unit by reversing the disassembling procedure. The casing covers should be assembled so as to be symmetrical with each other in the left-right direction and carefully so as not to damage the seal diaphragm. Tightening torque should follow the table below.

Bolt size	Bolt material	Tightening torque [N·m] (kgf·m) <ft-lb>	Maximum working pressure [MPa] {bar} <psi>	Application
M10	Cr-Mo steel	50 (5) <36>	42 {420} <6000>	Working pressure 42 MPa {420 bar} <6000 psi> or less
M10	SUS304 ASTMB7M ASTML7M	30 (3) <22>	10 {100} <1400>	Working pressure 10MPa {100 bar} <1400 psi> or less
M10	SUS630	50 (5) <36>	42 {420} <6000>	Working pressure 42 MPa {420 bar} <6000 psi> or less

(6) After assembly, carry out a pressure test (leak test). Apply a pressure equal to 150% of the maximum working pressure to both high pressure (H) and low pressure (L) measurement chambers of the transmitter simultaneously for 15 minutes, and make sure there is no leakage.

In case of absolute pressure and pressure transmitter (code symbol: FDA and FDG)



(1) Remove four bolts with a torque wrench, etc..

(2) Disassembly gives access to casing covers, O-rings (or gasket), bolts and nuts.

(3) After disassembly, replace the faulty part with a new one.

(4) Before reassembly, clean the O-ring face of casing cover with the soft cloth immersed in water, alcohol, or similar detergent.

(5) Reassemble the detecting unit by reversing the disassembling procedure. The casing covers should be assembled so as to be symmetrical with each other in the left-right direction and carefully so as not to damage the seal diaphragm. Tightening torque should follow the table below.

In case of absolute pressure transmitter (FDA)

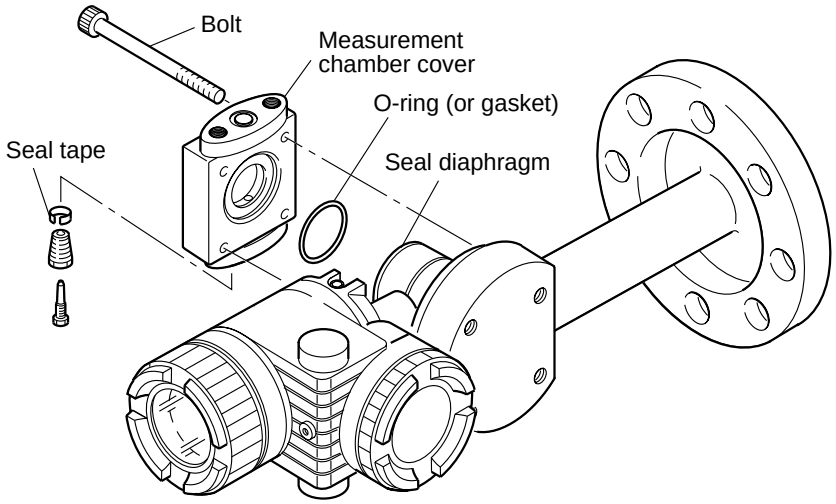
Bolt size	Bolt material	Tightening torque [N·m] (kgf·m) <ft-lb>	Maximum working pressure [MPa abs] {bar abs} <psi abs>	Application
M10	Cr-Mo steel	50 (5) <36>	3 {30} <430>	Common over entire range
M10	SUS304 ASTMB7M ASTML7M	30 (3) <22>	3 {30} <430>	

In case of pressure transmitter (FDG)

Bolt size	Bolt material	Tightening torque [N·m] (kgf·m) <ft-lb>	Maximum working pressure [MPa] {bar} <psi>	Application
M10	Cr-Mo steel	50 (5) <36>	50 {500} <7100>	Common over entire range
M10	SUS304 ASTMB7M ASTML7M	30 (3) <22>	10 {100} <1400>	Range 10000 [kPa] <1400 psi> or less
M10	SUS630	50 (5) <36>	50 {500} <7100>	Exclusive for range 50000 [kPa]

- After assembly, carry out a pressure test (leak test).
  Apply the allowable maximum pressure to the high pressure measurement chamber of the transmitter for 15 minutes, and make sure there is no leakage.

In case of level transmitter (code symbol: FDE, FDY)



(1) Remove four hexagon socket head bolts with a torque wrench, etc..

(2) Disassembly gives access to the casing cover, O-ring (or gasket) and hexagon socket head bolts.

(3) After disassembly, replace the faulty part with a new one.

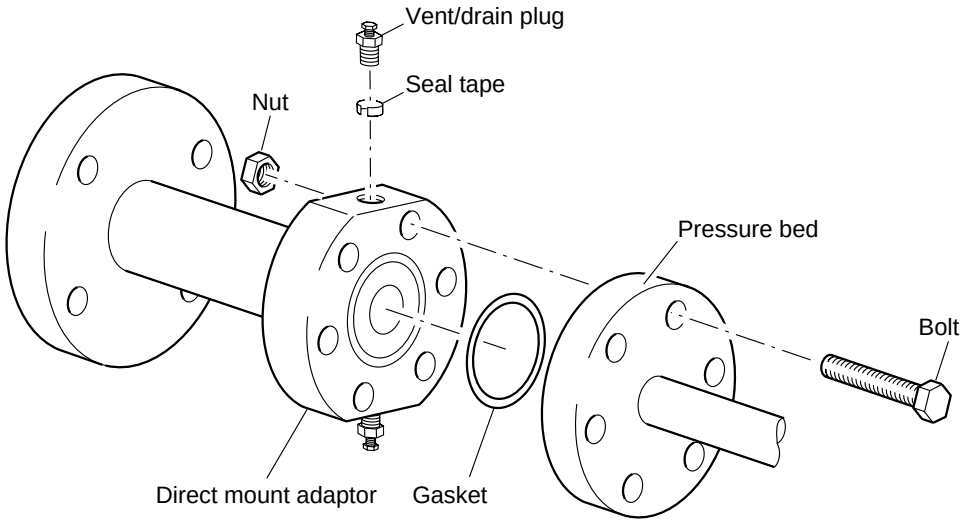
(4) Before reassembly, clean the O-ring face of casing cover with the soft cloth immersed in water, alcohol, or similar.

(5) Reassemble the detecting unit by reversing the disassembling procedure. The casing cover should be assembled carefully so as not to damage the seal diaphragm. Tightening torque should follow the table below.

Bolt size	Bolt material	Tightening torque [N·m] (kgf·m) <ft-lb>	Maximum working pressure
M10	Cr-Mo steel	50 (5) <36>	Up to rated flange pressure
M10	SUS304	30 (3) <22>	Up to rated flange pressure

(6) After assembly, carry out a pressure test (leak test). Apply a pressure equal to 150% of the maximum working pressure to both flange side (high pressure side) and low pressure (L) measurement chamber of the transmitter simultaneously for 15 minutes, and make sure there is no leakage.

Removing and mounting the direct mount adaptor for small size flange type transmitter. (code symbol: FDW, FDX, FDY)



(1) The direct mount adaptor is fitted to the pressure bed with six M8 bolts. Loosen the bolts and remove the adaptor.

(2) It is disassembled into direct mount adaptor, gasket, bolts and nuts.

(3) After disassembling, replace damaged parts with new ones.

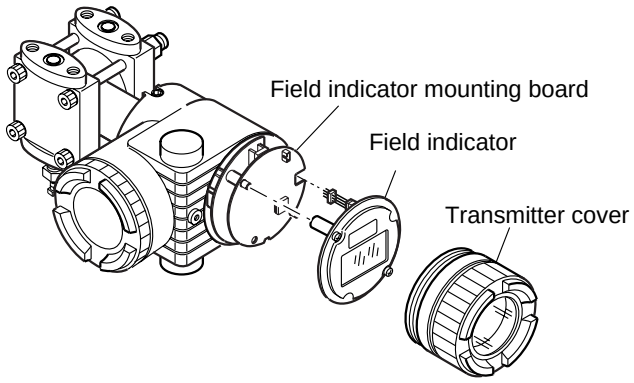
(4) Before reassembling, clean the direct mount adaptor, the pressure bed and the gasket with a soft cloth moistened with water or alcohol.

(5) Assemble all the parts in reverse order of disassembly.

When assembling, care should be taken not to damage the seal diaphragm at the pressure bed. Tighten the M8 bolts (SCM435) to 10N·m (1kgf·m) torque using a torque wrench.

(6) After assembly, carry out a pressure test (leak test). Apply a pressure (150% of rated flange pressure) to the direct mount adaptor for 15 minutes and confirm that it is free from leakage.

Replacement of field indicator



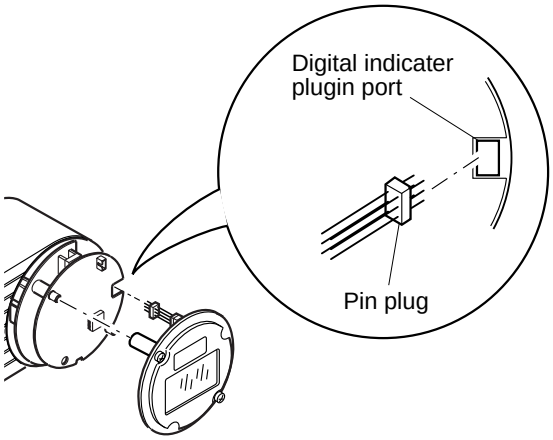
Replacing procedure

(1) Detach the transmitter cover.

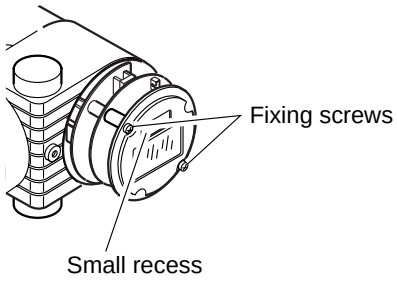
(2) Remove two fixing screws which fasten the field indicator and separate the indicator.

(3) Disengage the connector pin that connects the field indicator to the electronics unit except when only the field indicator itself is to be replaced.

(4) Connect the new field indicator and connector pin to the electronics unit.



(5) Fasten the digital indicator to the electronics section by tightening two fixing screws.



(6) Attach the transmitter cover.

7. INSTALLATION AND PIPING

7.1 Installation

After unpacking, check the delivered items.
This transmitter can be mounted on a pipe or on a wall.
(However, level transmitters (types: FDE, FDY) require flange mounting).

CAUTION

- The transmitter is heavy. Be careful when handling it.
- The transmitter should be installed in a place that meets the operating conditions shown in DS sheet or instruction manual.
- Install the transmitter according to the instruction manual. Improper installation may lead to the cause of fall, trouble or incorrect operation.
- When installing, make sure that the transmitter interior is free from cable chips and other foreign objects to prevent fire, trouble or incorrect operation.

DANGER

- Non-explosion-proof transmitter must not be used in a place with explosive gas to prevent serious accidents such as explosion, fire, etc.

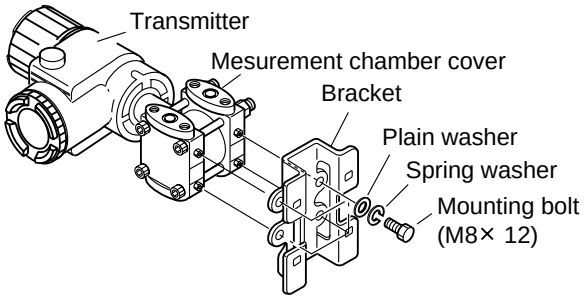
Important

If the transmitter is not used soon after delivery, then leave it packed and store it in a room at the normal temperature and humidity (25°C <77°F>, 60%RH).

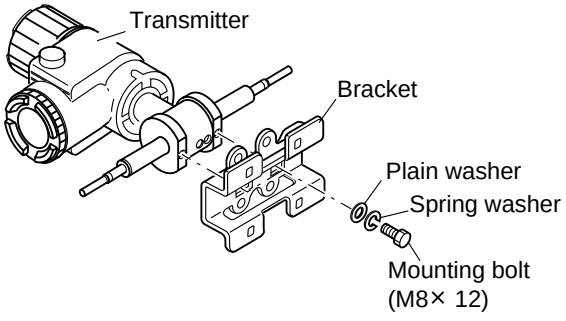
Bracket mounting

Mount the bracket to the transmitter.
The bracket should be mounted to the process cover as shown below.

Differential pressure/flow transmitters, pressure transmitters, and absolute pressure transmitters, types: FDC, FDG, FDA



Remote seal type transmitters, types: FDD, FDB, FDW, FDX



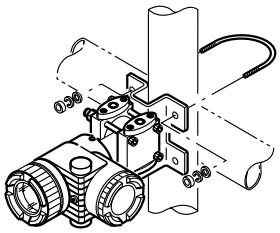
Mounting

Pipe mounting

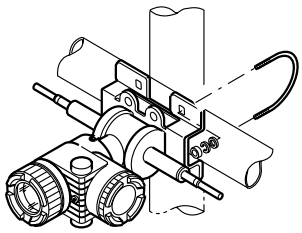
(1) Fasten the transmitter to a vertical or horizontal pipe using the supplied U-bolt (Tightening torque approximately 15 N·m (1.5 kgf·m)<11ft-lb>).

(2) Use a pipe of outside diameter ø60.5<2.38">mm.

(FDC, FDG, FDA)



(FDD, FDB, FDW, FDX)



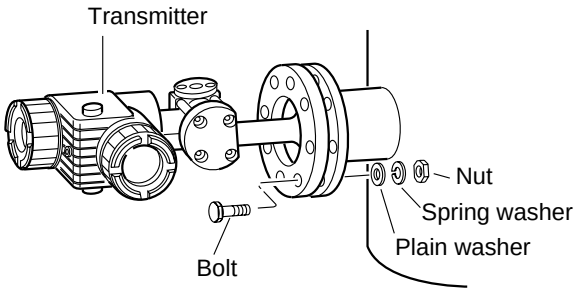
Wall mounting

(1) Fasten to wall face by M8 bolt utilizing the U-bolt holes.

Flange mounting

Bolt to tank flange.

(FDE, FDY)



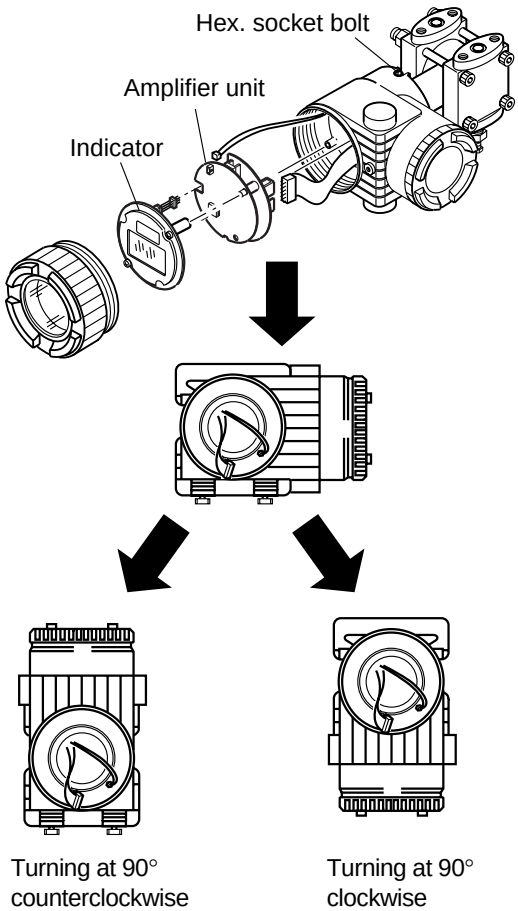
Change of amplifier unit position

CAUTION Avoid the following procedure in an explosionproof area.

Wiring is sometimes difficult depending on the installation location. In such a case, it is convenient to carry out the following.

Before turning the amplifier unit, remove the electronics unit.

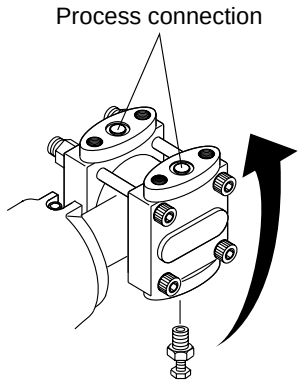
The amplifier unit is secured by 2 hex socket bolts. Loosen the bolts, turn the amplifier unit at 90˚ or 180˚ in the clockwise or counterclockwise direction and fix it by the screws. Then, carry out wiring.



Important If the transmitting unit has been turned more than 360° without removing the amplifier unit, the flatcable which interconnects amplifier unit and detecting unit may twist. In such a case, remove the twisting before reassembly.

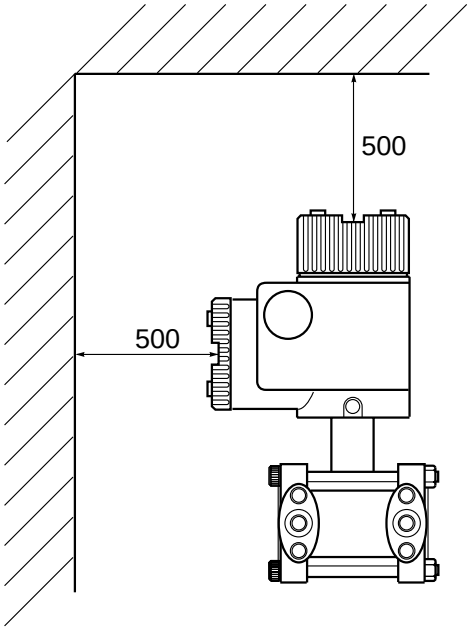
Change of vent/drain plug position

Grasp the hexagon part of vent/drain plug and rotate it to remove.
Bind vent/drain plug's thread with new seal tape and mount vent/drain plugs to new process connections.
Tightening torque : 25N·m (2.5kgf·m) <18ft·lb>
After remounting the vent/drain plug, check the airtightness upon applying a pressure.



Check space

Ensure a space of about 500mm against the cover in order to facilitate check, adjustment, etc.



7.2 Piping

It is generally recognized that there are appropriate positioning relationship between the transmitter and main process piping for accurate measurement to avoid harmful gas or liquid accumulation.
General recognizations are;

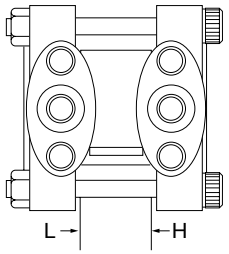
(1) Mount transmitter below main process piping for liquid or steam measurement.
(2) Mount transmitter above main process piping for gas measurement.

The above concept is important not to let the gas (or drain), which enters the piping from the process pipe, stay within the piping but let it return to the process pipe by itself.
The standard FCX-AⅡ-series transmitters are provided with a pressure connection port and a vent/drain plug to allow the installation of piping by the method in (1) above. By reversing the vent/drain plug, the piping can also be installed by the method in (2).

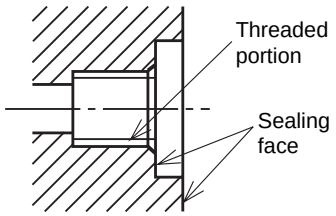
⚠ CAUTION	Main valve used for piping should be selected with the maximum pressure of the process taken into account (piping parts such as main valve, etc. should be furnished by user). If the main valve and other parts do not meet the rating, it may result in leakage of gas or liquid which could lead to a hazard.

7.2.1 Piping of differential pressure and flow transmitter (type: FDC)

Check of high/low pressure sides of transmitter
The detecting unit of the differential pressure transmitter bears symbols H and L which represent high and low pressure sides, respectively.



Removal of protective cap
The process connection ports of the transmitter and manifold (equalizer) valve are fitted with protective caps. Before piping, be sure to remove the caps. When removing the caps, carefully protect the threaded portion and sealing face from damage.



Connection of transmitter and impulse pipes

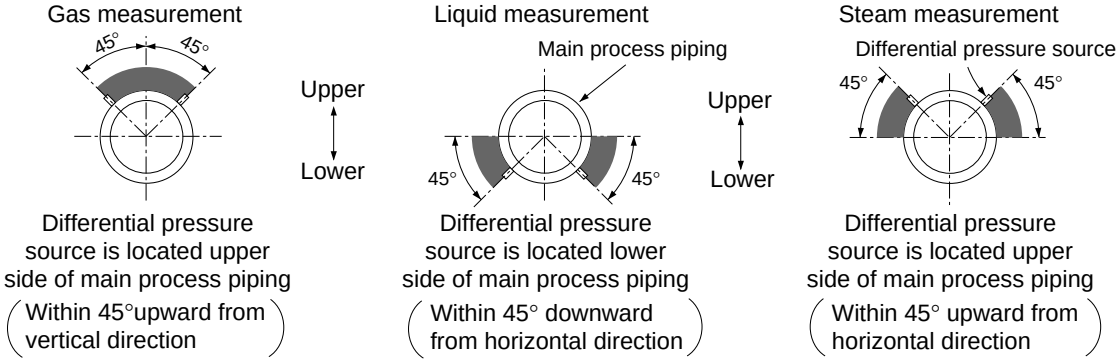
(1) When using the manifold valve, it should be fixed to the transmitter by tightening four oval flange setbolts (7/16-20UNF), and then the impulse pipe should be connected to the manifold valve. Tightening torque of 7/16-20UNF mounting bolt should be 30 to 40 N·m (3 to 4 kgf·m).

(2) If a manifold valve is not used, the impulse pipes can directly be screwed into the transmitter. If thread size does not match between the transmitter and impulse pipes, an oval flange should be used. Tightening torque of 7/16-20UNF mounting bolt in an oval flange should be 30 to 40 N·m (3 to 4 kgf·m).

Position of process taps (Horizontal main process piping)

The position of the process tap is determined by the relationship between the condition, characteristics and measuring point of the process fluid.

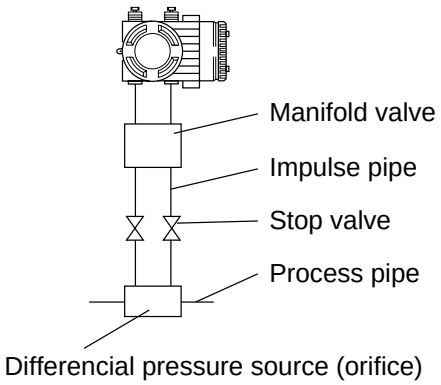
Note the following figures when planning and installing the piping.



Typical examples of piping

1 Flow measurement (in case of gas)

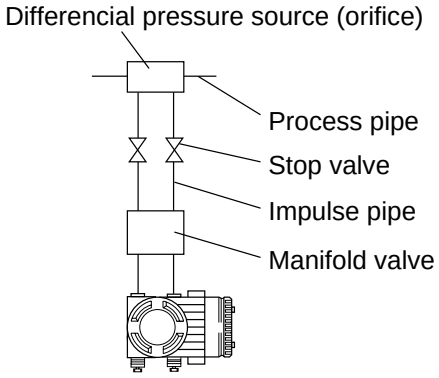
Place the transmitter above the differential pressure source.



2 Flow measurement (in case of liquid)

Place the transmitter below the differential pressure source.

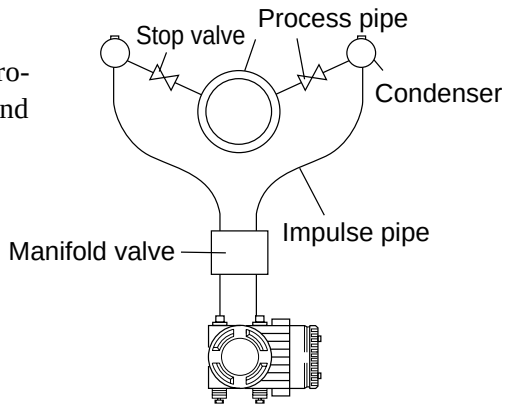
Make piping so that gas in the impulse pipe is not delivered to the transmitter, and incorporate gas reservoirs as required.



3 Flow measurement (in case of steam)

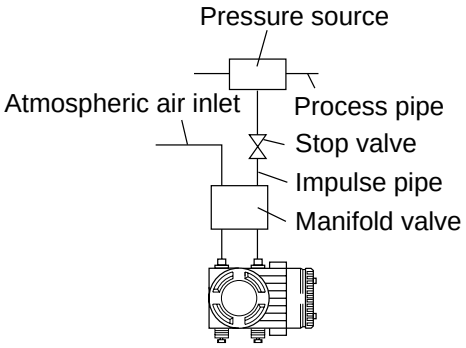
Set two condensers at the same height near the process tap. Fill the line between the condensers and transmitter with condensed water.

Install a drain port as required.



④ Pressure measurement (in case of liquid)

Zero point can be checked with a manifold valve installed.



Important

(1) Protection is required to prevent dust from entering through the atmospheric air inlet after installation of the manifold valve.

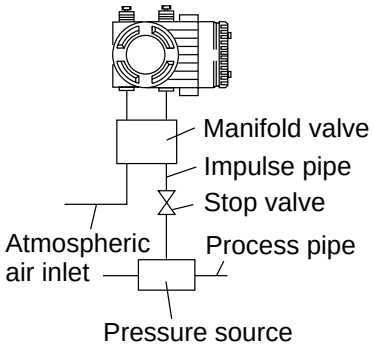
(2) If process pressure range is narrow (below 10kPa (1000mmH_2O)), the following should be considered.

- Pressure variation due to wind around atmospheric air inlet

To overcome this, provide atmospheric pressure-side pipe with a proper orifice and consider accommodating the transmitter and atmospheric air inlet in a box.

⑤ Pressure measurement (in case of gas)

Mount the transmitter above the process pipes to preventing moisture from entering the inside of transmitter.



⑥ Level measurement

(1) In case of wet leg:

For measurement, connect the highest liquid level tapping of tank to the low pressure side of transmitter, and the lowest liquid level tapping of tank to the high pressure side of transmitter.

Level calculation formula

LRV : $\rho H_2 - \rho_0 H_1$

URV : $\rho H_2 + \rho_1 h - \rho_0 H_1$

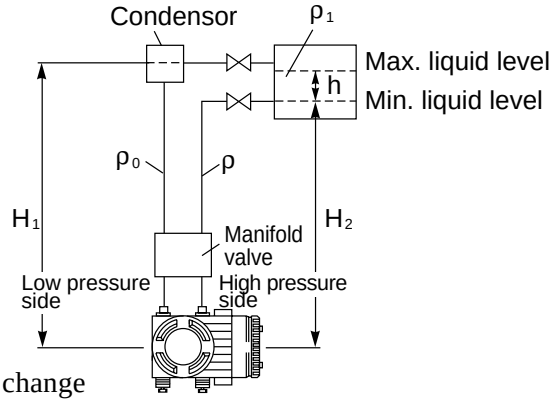
Span (ΔP): $\rho_1 h$

LRV : Low limit of measurement (0% point)

URV : High limit of measurement (100% point)

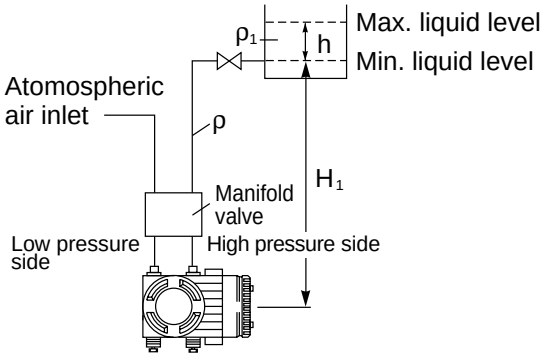
ρ_0, ρ, ρ_1: Density

H_1, H_2: Liquid level, h: Liquid level change



(2) In case of dry leg:

For an open tank, leave the low pressure side of transmitter open to atmosphere.



Level calculation formula

LRV: ρH_1

URV: $\rho H_1 + \rho_1 h$

Span (ΔP): $\rho_1 h$

LRV: Low limit of measurement (0% point)

URV: High limit of measurement (100% point)

ρ,ρ_1: Density

H_1: Liquid level, h: Liquid level change

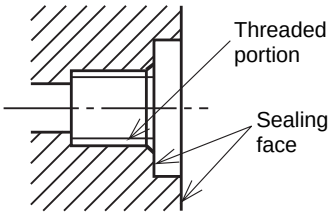
Cautions on piping

- For liquid, the impulse pipes should have an upward slope of 1/10 or more between the process connection and the transmitter to prevent accumulation of gas, etc. in the detecting unit.
- For gas, the impulse pipes should have a downward slope of 1/10 or more between the process connection and transmitter to prevent accumulation of moisture, etc. in the detecting unit.
- Avoid any sharp bends in impulse pipe which may cause gas or moisture to accumulate in the impulse pipe.
- Take care not to apply an excessive force to the transmitter during its connection.
- The impulse pipes used should be suitable for the working temperature, pressure, etc.
- When the measuring fluid is likely to freeze in the cover of the measurement chamber, the cover needs to be warmed up with steam or a heater.
- After piping, be sure to check the airtightness.

7.2.2 Piping of pressure and absolute pressure transmitter (types: FDG, FDA)

Removal of protective cap

The process connection port of the transmitter is fitted with a protective cap. Before piping, remove the cap carefully. When removing the cap, carefully protect the threaded portion and sealing face from damage.



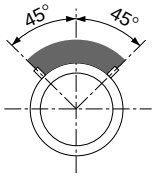
Connection of transmitter and impulse pipe

- Impulse pipe should be connected with an oval flange. Also, the pipe can directly be screwed into the transmitter. Tightening torque of 7/16-20UNF mounting bolt in an oval flange should be 30 to 40 N·m (3 to 4 kgf·m).
- After connection, close the stop valve of transmitter in order to prevent foreign materials from entering the inside.

Position of process taps (Horizontal main process piping)

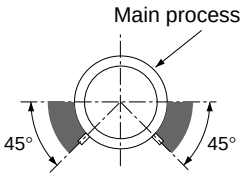
The position of the process tap is determined by the relationship between condition, characteristics and measurement point of process fluid. Note the following figures when planning and installing the piping.

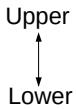
Gas measurement



Pressure source is located upper side of main process piping
(Within 45°upward from vertical direction)

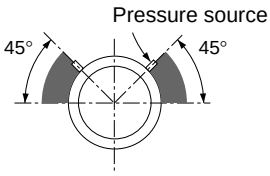
Liquid measurement





Pressure source is located lower side of main process piping
(Within 45° downward from horizontal direction)

Steam measurement

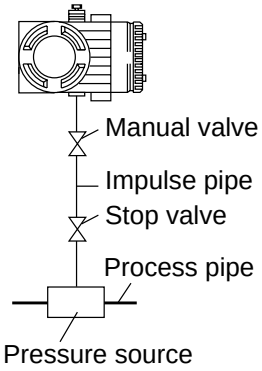


Pressure source is located upper side of main process piping
(Within 45° upward from horizontal direction)

Typical examples of piping

(1) Gas measurement

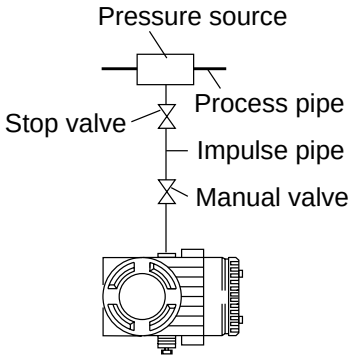
Place the transmitter above the pressure source.



(2) Liquid measurement

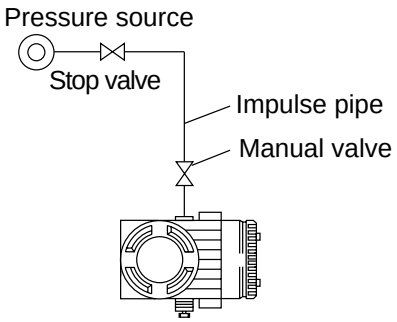
Place the transmitter below the pressure source.

Make piping so that gas in the process pipe is not delivered to the transmitter, and incorporate gas reservoirs as required.



(3) Steam measurement

Place the transmitter below the pressure source.



Cautions on impulse piping

- For liquid, the impulse pipe should have an upward slope of 1/10 or more between the process connection and transmitter to prevent accumulation of gas, etc. in the detecting unit.
- For gas, the impulse pipe should have a downward slope of 1/10 or more between process connection and transmitter to prevent accumulation of moisture, etc. in the detecting unit.
- Avoid any sharp bends in impulse pipe which may cause gas or moisture to accumulate in the impulse pipe.
- Take care not to apply an excessive force to the transmitter during its connection.

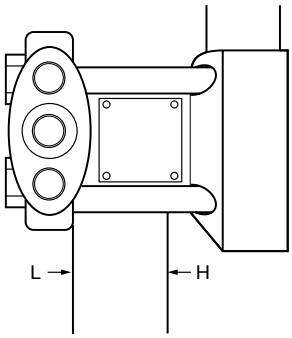
⚠ CAUTION	The impulse pipe used should be suitable for the working temperature, pressure, etc.

- When the measuring fluid is likely to freeze in the cover of the measurement chamber, the cover needs to be warmed up with steam or a heater.
- After piping, be sure to check the airtightness.

7.2.3 Piping of level transmitter (types: FDE, FDY)

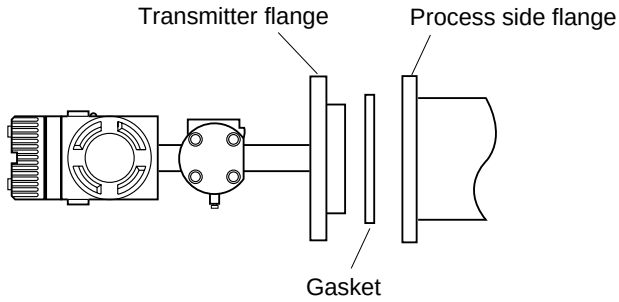
Check of high/low pressure sides of transmitter

The detecting unit of the level transmitter bears symbols H and L which represent high and low pressure sides, respectively.



Seal on mounting flange face

When mounting the flange on the high pressure side, a gasket should be inserted as follows.



Important

On the flush flange type, be sure to use a gasket with an internal diameter larger than shown in the table below, to prevent the gasket from touching the seal diaphragm.
On the 80A (3B) type particularly, it should be noted that the 80A (3B) gasket available from the market is such that its inside diameter is smaller than the size shown below. If it is used, it touches the seal diaphragm and cause errors in measurements.

Minimum internal diameter of flush flange type gasket

Flange size	Minimum internal diameter of gasket
40A ($1^1/_2$B), 50A (2B)	49mm
80A (3B), 100A (4B)	100mm

Important

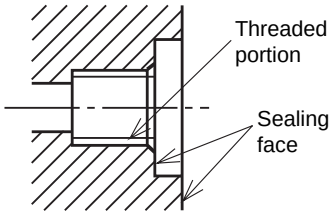
It should be noted that leakage of fluid from the wetted parts would affect the performance due to the progress of corrosion.

Connecting method of the mounting flange

Tighten bolts of mounting flange and process flange in a diagonal order and about three cycles.

Removal of protective cap from process connection port

The process connection port on the low pressure side is fitted with a protective cap. Before piping, remove the cap carefully. When removing the cap, carefully protect the threaded portion and sealing face from damage.



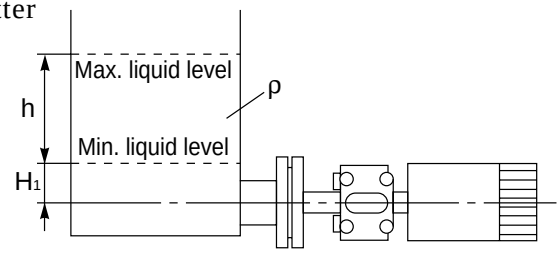
Connection of transmitter and impulse pipe

- The pipe on the low pressure side can be connected with an oval flange. Also, the impulse pipe can directly be screwed into the transmitter. Tightening torque of 7/16-20UNF mounting bolt in an oval flange should be 30 to 40 N·m (3 to 4 kgf·m).
- After connection, close the stop valve of transmitter in order to prevent foreign materials from entering the inside.

Typical examples of piping

1 Level measurement of open tank

Leave the low pressure side of transmitter open to atmosphere.



Level calculation formula

LRV: ρH_1

URV: $\rho (H_1 + h)$

Span (ΔP): ρh

LRV: Low limit of measurement (0%)

URV: High limit of measurement (100%)

ρ: Measuring liquid density

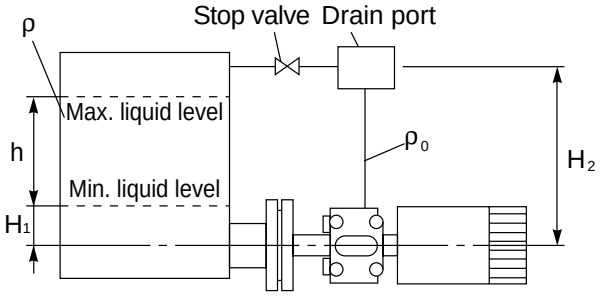
H_1: Liquid level (Refer to "Cautions on piping")

h: Liquid level change

2 Level measurement of enclosed tank

(1) In case of wet leg:

Connect the highest liquid level tapping of tank to the low pressure side of transmitter, and the lowest liquid level tapping of tank to the high pressure side (flange side) of transmitter.



Level calculation formula

LRV: $\rho H_1 - \rho_0 H_2$

URV: $\rho (H_1 + h) - \rho_0 H_2$

Span (ΔP): ρh

LRV: Low limit of measurement (0%)

URV: High limit of measurement (100%)

ρ: Measuring liquid density

ρ_0: Seal liquid density

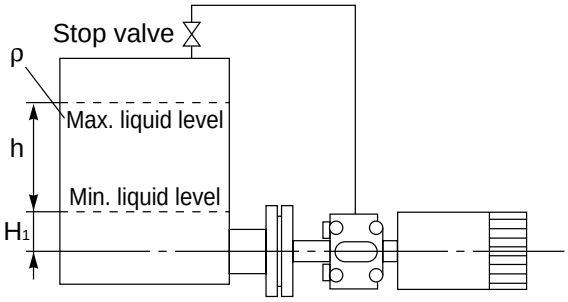
H_1: Liquid level (Refer to "Cautions on piping")

h: Liquid level change

H_2: Seal liquid level

(2) In case of dry leg:

Connect the highest liquid level tapping of tank to the low pressure side of transmitter, and the lowest liquid level tapping of tank to the high pressure side (flange side) of transmitter.



Level calculation formula

LRV: ρH_1

URV: $\rho (H_1 + h)$

Span (ΔP): ρh

LRV: Low limit of measurement (0%)

URV: High limit of measurement (100%)

ρ: Measuring liquid density

H_1: Liquid level (Refer to "Cautions on piping")

h: Liquid level change

Cautions on piping

- Restriction on H_1

  Liquid level is not proportional to the transmitter output at some points inside the seal diaphragm.
  Therefore, H_1 should be set higher than the value shown in the table below.

Minimum value of H_1

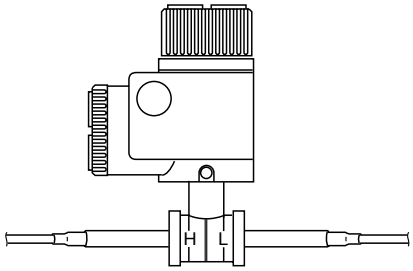
Flange size	Flush flange type	Extension flange type
40A ($1^1/_2$B)	30mm	——
50A (2B)	30mm	30mm
80A (3B)	55mm	40mm
100A (4B)	55mm	55mm

- Do not shock the seal diaphragm by hitting hard object against it, for example.
- Take care not to apply an excessive force to the flange during connection.
- When the measuring fluid is likely to freeze in the cover of the low pressure measurement chamber, the cover needs to be warmed up with steam or a heater.
- After piping, be sure to check the airtightness.

7.2.4 Piping of remote seal type differential pressure transmitter (types: FDD, FDX)

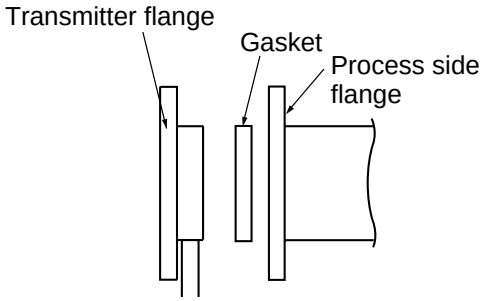
Check of high/low pressure sides of transmitter

The detecting unit of the remote seal type differential pressure transmitter bears symbols H and L which represent high and low pressure sides, respectively.



Seal on mounting flange face

When mounting the flange, a gasket should be inserted as follows.



Important

On the flush flange type, be sure to use a gasket with an internal diameter larger than shown in the table below, to prevent the gasket from touching the seal diaphragm.
On the 80A (3B) type particularly, it should be noted that the 80A (3B) gasket available from the market is such that its inside diameter is smaller than the size shown below. If it is used, it touches the seal diaphragm and cause errors in measurements.

Minimum internal diameter of flush flange type gasket

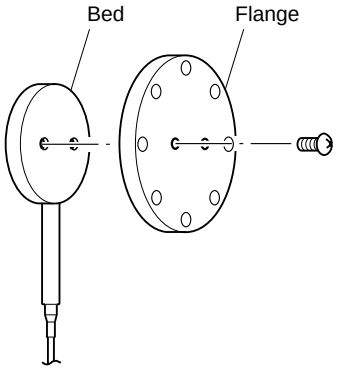
Flange size	Minimum internal diameter of gasket
40A ($1^1/_2$B), 50A (2B)	49mm
80A (3B), 100A (4B)	100mm

Important

When measuring a highly corrosive process fluid, care should be taken as corrosion may occur if the fluid leaks past wetted parts.

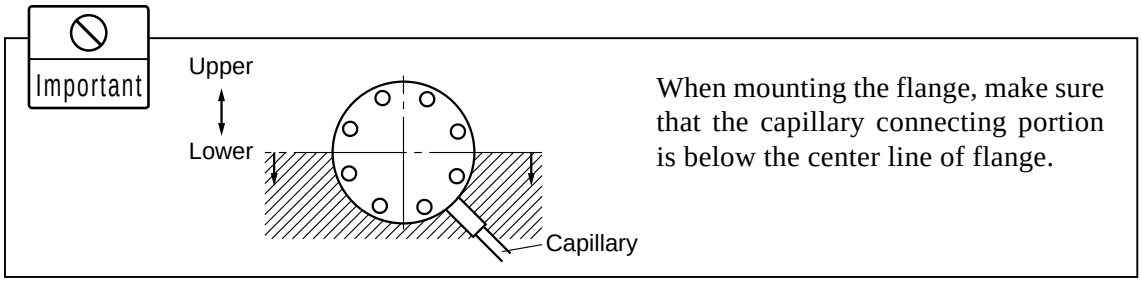
Connecting method of the mounting flange

Tighten the bolts of mounting flange and process flange in a diagonal order and about three cycles.



Mounting of flange and bed

The bed has two screw holes on the back face. It is therefore recommended to mount the bed to the flange in advance by tightening screws (M6). The flange should be supplied by the customer.

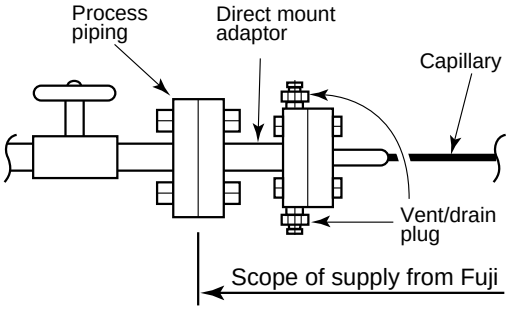


When mounting the flange, make sure that the capillary connecting portion is below the center line of flange.

Piping for small flange transmitter with direct mount adaptor

When connecting the direct mount adaptor to the process piping, make sure that the 2 vent/drain plugs fitted to the adaptor are positioned up and down, respectively.

Gaskets, bolt and nuts used for connecting the process piping are not supplied from Fuji, and should be prepared by user.

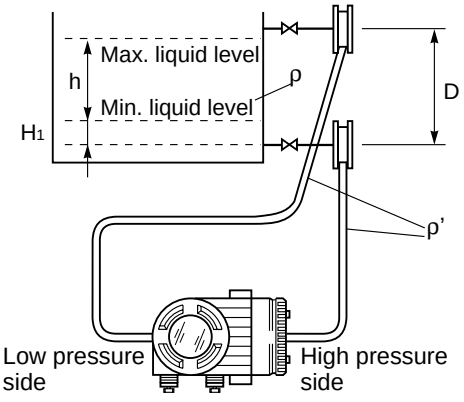


Typical examples of piping

Level measurement

(1) Open tank

An open tank should be piped so that the flange on the low pressure side is open to atmosphere.



Level calculation formula

LRV: $\rho H_1 - \rho' D$

URV: $\rho (H_1 + h) - \rho' D$

Span (ΔP): ρh

LRV: Low limit of measurement (0%)

URV: High limit of measurement (100%)

ρ: Measuring liquid density

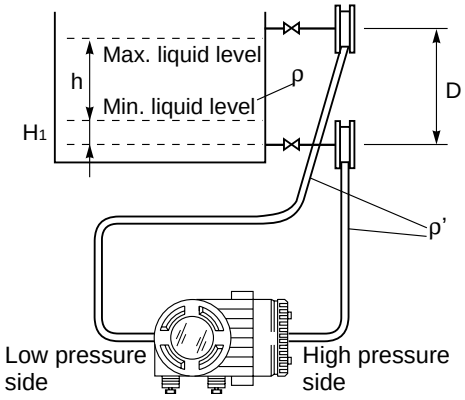
ρ': Seal liquid density

H_1: Liquid level (Refer to "Cautions on installation")

h: Liquid level change

(2) Enclosed tank

Connect the low pressure side flange to the highest liquid level tapping of tank, and the high pressure side flange to the lowest liquid level tapping of tank.



Level calculation formula

LRV: $\rho H_1 - \rho' D$

URV: $\rho (H_1 + h) - \rho' D$

Span (ΔP): ρh

LRV: Low limit of measurement (0%)

URV: High limit of measurement (100%)

ρ: Measuring liquid density

ρ': Seal liquid density

H_1: Liquid level (Refer to "Cautions on piping")

h: Liquid level change

* The seal liquid density ρ' is a value at 25°C.

13th digit of type code	Density (g/cm^3)	Description
Y, G	0.96	For general measurement (silicone oil)
W, A, D	1.9	For oxygen and chlorine measurement (fluorine-group oil)
H, S, K	1.07	For high temperature, high temperature and vacuum, and high temperature and high vacuum (silicone oil)
J, T	1.09	

Important

The transmitter body should be installed below any pressure receiving unit. This is mandatory where process pressure may become vacuum due to application.

Cautions on piping

- Restriction on H_1

  Liquid level is not proportional to the transmitter output at some pints inside the seal diaphragm. Therefore, H_1 should be set higher than the value shown in the table below.

  Minimum value of H_1

Flange size	Flush flange type	Extension flange type
40A ($1^1/_2$B)	30mm	——
50A (2B)	30mm	30mm
80A (3B)	55mm	40mm
100A (4B)	55mm	55mm

- In order to prevent vibration of the transmitter body and capillary from interfering with output, the transmitter body should be installed at a vibration-free place and the capillary should be fixed to a stable support.
- For minimizing the influence by a difference in the ambient temperature, the capillaries on the high and low pressure sides should be laid together.
- Do not shock the seal diaphragm by hitting a hard object against it, for example.

- Water head pressure due to difference in the height of flange

  When there is a difference (D) in flange mounting position between the high-pressure side and the low-pressure side, a water pressure head "–ρ'D" is applied to the transmitter, so a zero point shift for the water head pressure (–ρ'D) due to difference in height of flange is required at range setting as shown in the example of typical piping.

  On the FCX-AⅡ series transmitter, the zero point shift can be made by the following methods.

  1. Range change (LRV, URV) with the HHC
  2. Change of LRV in rerange with the HHC

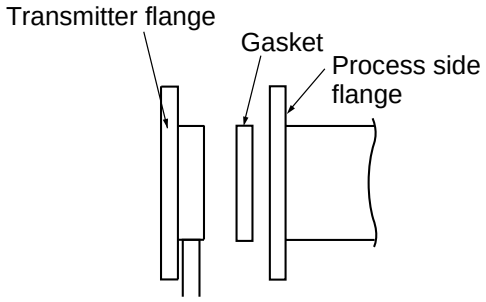
  For details of the necessary procedure, refer to the relevant item.

- After piping, be sure to check the airtightness.

7.2.5 Piping of remote seal type pressure transmitter (types: FDB, FDW)

Seal on mounting flange face

When mounting the flange, a gasket should be inserted as follows.



Important

On the flush flange type, be sure to use a gasket with an internal diameter larger than shown in the table below, to prevent the gasket from touching the seal diaphragm.
On the 80A (3B) type particularly, it should be noted that the 80A (3B) gasket available from the market is such that its inside diameter is smaller than the size shown below. If it is used, it touches the seal diaphragm and cause errors in measurements.

Minimum internal diameter of flush flange type gasket

Flange size	Minimum internal diameter of gasket
40A ($1^1/_2$B), 50A (2B)	49mm
80A (3B), 100A (4B)	100mm

Important

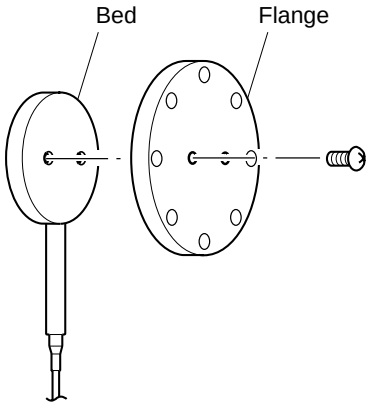
When measuring a highly corrosive process fluid, care should be taken as corrosion may be aggravated if the fluid leaks out of wetted parts.

Connecting method of the mounting flange

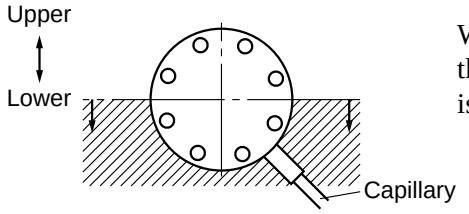
Tighten the bolts of mounting flange and process pipe flange in a diagonal order and about three cycles.

Mounting of flange and bed

The bed has two screw holes on the back face. It is therefore recommended to mount the bed to the flange in advance by tightening screws (M6). The flange should be supplied by the customer.



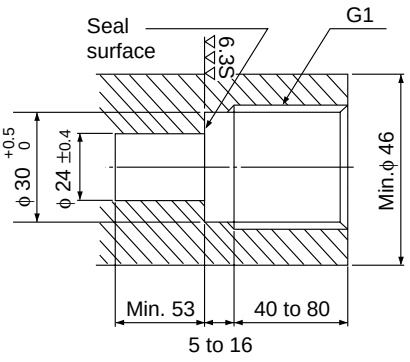
Important



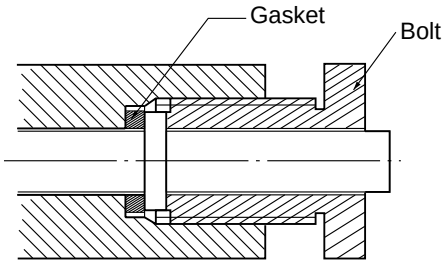
When mounting the flange, make sure that the capillary connecting portion is below the center line of flange.

Mounting method of screw-in type diaphragm section

(1) The diaphragm section of this transmitter is of G1 screw-in type. Process tap should be made as shown below. Also, care should be taken so that the sealing face will be free from damages, contaminants, etc.

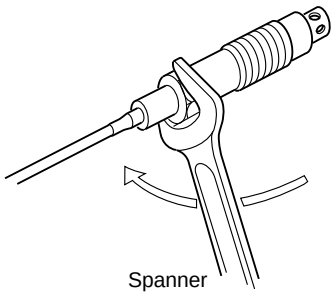


(2) Install the furnished gasket.



(3) After confirming that the aluminum gasket is inserted, screw in the bolt manually until the bolt no longer moves. Then tighten the bolt firmly with a wrench.

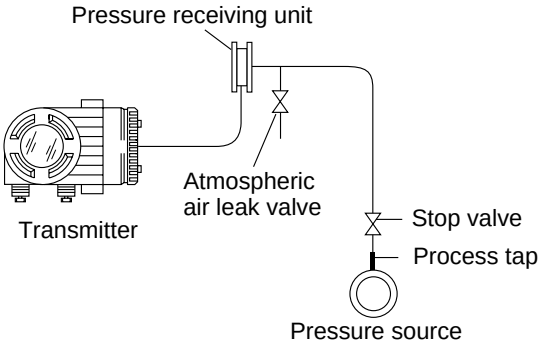
Spanner nominal size : 38
Tightening torque : 110N•m



Typical examples of piping

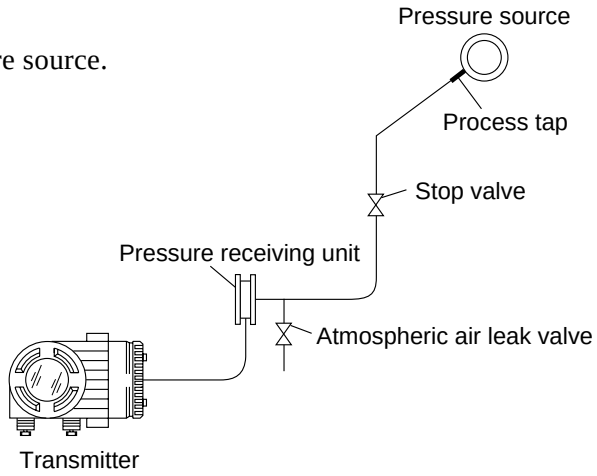
1 Gas measurement

Locate the process tap above the pressure source.



2 Liquid measurement

Locate the process tap below the pressure source.



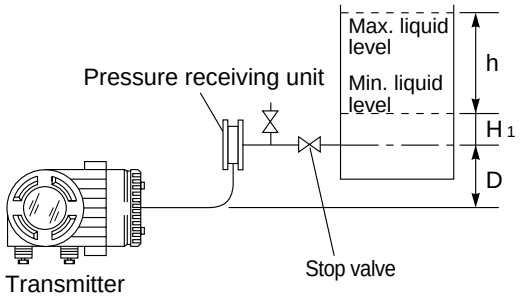
3 Level measurement

Open tank

An open tank should be connected on the lowest liquid level tapping point.

Level calculation formula

LRV: $\rho H_1 + \rho' D$
URV: $\rho (H_1 + h) + \rho' D$
Span (ΔP): ρh
LRV: Low limit of measurement (0%)
URV: High limit of measurement (100%)
ρ: Measuring liquid density
ρ': Seal liquid density
H_1: Liquid level (Refer to "Cautions on piping")
h: Level change



Important

The transmitter body should be installed below any pressure receiving unit. This is mandatory where process pressure becomes vacuum due to application.

Cautions on piping

- Restriction on H_1

  Liquid level is not proportional to the transmitter output at some pints inside the seal diaphragm. Therefore, H_1 should be set higher than the value shown in the table below.

  Minimum value of H_1

Flange size	Flush flange type	Extension flange type
40A ($1^1/_2$B)	30mm	——
50A (2B)	30mm	30mm
80A (3B)	55mm	40mm
100A (4B)	55mm	55mm

- In order to prevent vibration of the transmitter body and capillary from interfering with output, the transmitter body should be installed at a vibration-free place and the capillary should be fixed to a stable support.
- Do not shock the seal diaphragm by hitting hard object against it, for example.
- After piping, be sure to check the airtightness.

8. WIRING

Cautions on wiring

(1) Application of a voltage exceeding 32 V DC between "+" and "–" terminals may result in damage to the transmitter.

(2) Use type A cable of the Fieldbus Association where possible.

(3) Avoid installation of signal cable and power cable in same conduit or cable tray in order to prevent increased noise. Also, do not bring the signal cable close to large electrical equipment.

DANGER

In case of an explosionproof arrangement, wiring shall be made in accordance with the relevant regulations to ensure the explosionproofing.

Effect of cellular phone

The use of a cellular phone near the transmitter or the cables may adversely affect the output of the transmitter. Do not use a cellular phone within 20cm of the transmitter or the cables.

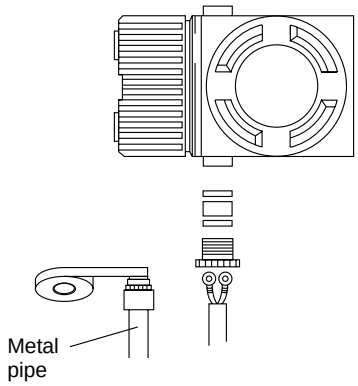
8.1 Wiring procedure

CAUTION

- Before making wiring work, be sure to turn OFF the main power to prevent electric shocks.
- Use wiring materials of correct rating to prevent fire accidents.
- After installing the transmitter, firmly close the covers of the amplifier unit and terminal box. If not, rain water enter the transmitter which may result in trouble or incorrect operation.

Sealing of conduit connection

To ensure airtightness of the conduit connection, use sealing tape for metal pipe screw coupling, and rubber gasket, fastening gland, etc. for JIS F8801 A15C for the ø11 cable.

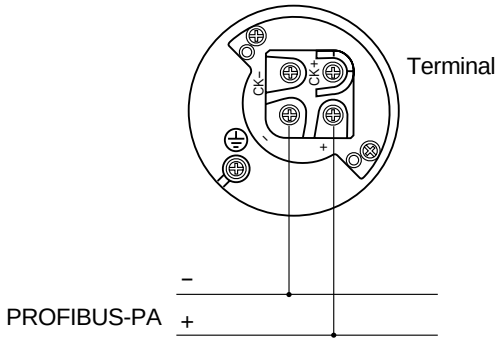


Important

1. If the connection box is located above the transmitter when using a protective tube for the wiring, then moisture may enter the protective tube and have an adverse effect on the transmitter. So maintaining airtightness of the connection box is an important practice.
2. The thread of conduit tube should meet the selected size (parallel pipe thread G1/2).

Terminal block connection diagram

Tighten the terminal screws (M4 × 10) to a torque of approximately 1.5 N·m (15 kgf·cm) <11ft-lb> so that the wires will not loosen.
After connection, fasten the cover until it does not turn.



Important

For terminal connection, do not mistake the "+" and "–" polarities of power source.

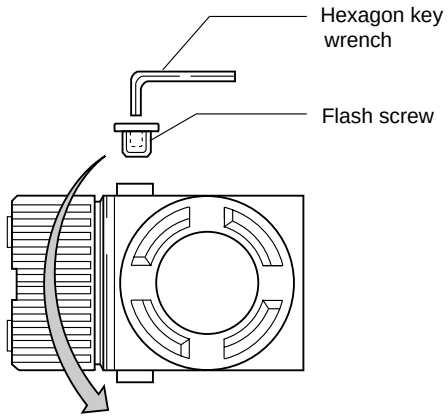
Things convenient to know beforehand

When using conduit connection at the top
(In the case of 4th digit of type code "S, T, V, W, X")
For wiring from the top conduit connection, use the following procedure.

(1) Remove the screw plug of the top conduit connection.

(2) Screw the removed screw plug into the bottom conduit connection.

(3) Insert the cable from the top and connect it.

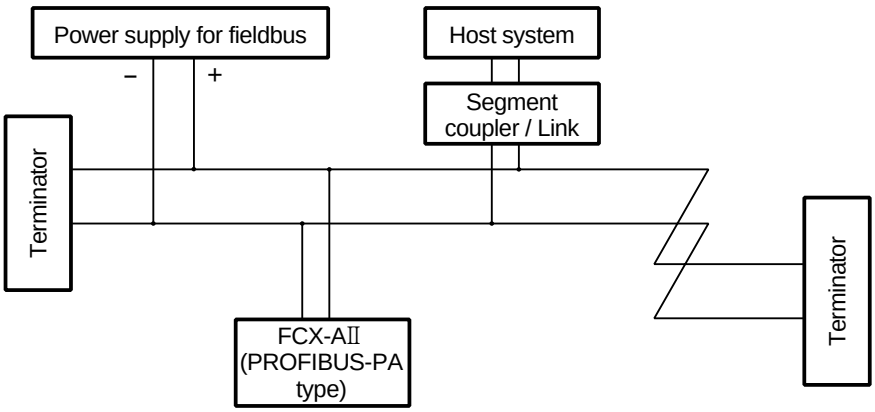


Important

- The unused conduit connection is of great importance to flameproofing and moisture prevention. So be sure to tighten the flush screw and packing into the connection.

8.2 Configuration of PROFIBUS-PA connection

In order that the PROFIBUS-PA equipment can be used, the following configuration of connection is necessary.



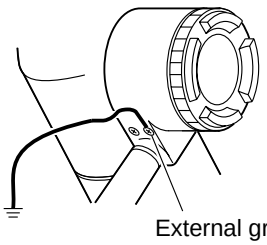
Configuration of PROFIBUS-PA connection

8.3 Grounding

⚠ CAUTION	The transmitter must be grounded as described below. Otherwise, it may cause electric shocks or incorrect operation.

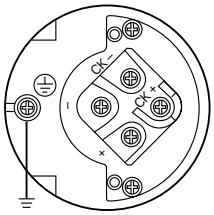
Grounding terminals are provided at the inside of terminal box and on the side of conduit connection. By any of the methods given below, carry out grounding wiring of class D or better (grounding resistance 100 (or less). In case of intrinsically safe and flameproof installation, be sure to use the ground terminal for grounding.

Grounding of transmitter casing



External grounding terminal

Grounding from ground terminal



Appendix 1 CALIBRATION

Preparation for calibration

The transmitter should be calibrated in a calibration room. For calibration of each transmitter, the following devices are required.

- Pressure source and pressure measuring equipment (should have as high an accuracy as possible)
  * Measurable ranges are listed in the table below.
- Link master (FOUNDATION FIELDBUS type)

Measurable range

Differential pressure range of differential pressure transmitter (FDC)

Differential pressure range [kPa] {mbar} <inH$_2$O>
0.1 to 1 {1 to 10} <0.4 to 4>
0.1 to 6 {1 to 60} <0.4 to 24>
0.32 to 32 {3.2 to 320} <1.25 to 12.5>
1.3 to 130 {13 to 1300} <5.2 to 520>
5 to 500 {50 to 5000} <0.7 to 70psi>
30 to 3000 {300 to 30000} <4.3 to 430psi>

Pressure range of pressure transmitter (FDG)

Pressure range [kPa] {bar} <psi>
1.3 to 130 {0.013 to 1.3} <0.2 to 20>
5 to 500 {0.05 to 5} <0.7 to 70>
30 to 3000 {0.3 to 30} <4.3 to 430>
100 to 10000 {1 to 100} <15 to 1500>
500 to 50000 {5 to 500} <70 to 7000>

Pressure range of absolute pressure transmitter (FDA)

Pressure range [kPa abs] {bar•abs} <inHg abs>
1.6 to 16 {0.016 to 0.16} <0.46 to 4.6>
1.6 to 130 {0.16 to 1.3} <0.46 to 38>
5 to 500 {0.05 to 5} <0.7 to 70psi abs>
30 to 3000 {0.3 to 30} <4.3 to 430psi abs>

Differential pressure range of remote seal type differential pressure transmitter (FDD)

Differential pressure range [kPa] {bar} <inH$_2$O>
0.32 to 32 {0.0032 to 0.32} <1.25 to 125>
1.3 to 130 {0.013 to 1.3} <5.2 to 520>
5 to 500 {0.05 to 5} <0.7 to 70psi>

Pressure range of remote seal type pressure transmitter (FDB)

Pressure range [kPa] {bar} <psi>
1.3 to 130 {0.013 to 1.3} <0.2 to 20>
5 to 500 {0.05 to 5} <0.7 to 70>
30 to 3000 {0.3 to 30} <4.3 to 430>
100 to 10000 {1 to 100} <15 to 1500>
500 to 50000 {5 to 500} <70 to 7000>

Differential pressure range of level transmitter (FDE)

Differential pressure range [kPa] {mbar} <inH$_2$O>
0.32 to 32 {3.2 to 320} <1.25 to 125>
1.3 to 130 {13 to 1300} <5.2 to 520>
5 to 500 {50 to 5000} <0.7 to 70psi>

Differential pressure range of remote seal type differential pressure transmitter (FDX)

Differential pressure range [kPa] {mbar} <inH$_2$O>
3 to 130 {30 to 1300} <12 to 520>
12.5 to 500 {125 to 5000} <50 to 2000>

Pressure range of remote seal type pressure transmitter (FDW)

Pressure range [kPa] {bar} <psi>
50 to 3000 {0.5 to 30} <7.2 to 430>
250 to 10000 {2.5 to 100} <37.5 to 1500>

Differential pressure range of level transmitter (FDY)

Differential pressure range [kPa] {mbar} <inH$_2$O>
3 to 130 {30 to 1300} <12 to 520>
12.5 to 500 {125 to 5000} <50 to 2000>

(1) Zero/span adjustment
Refer to “Zero/span adjustment” in Chapter 5.

(2) Accuracy test
Apply input pressures in the order of 0%, 25%, 50%, 75%, 100%, 75%, 50%, 25% and 0%, and read output at each input pressure.
Make sure the difference between each output value and input pressure (%) is within the accuracy rating listed in the table below.

Measurement category	Reference value	Accuracy (example)	
		Accuracy:0.1%	Accuracy:0.2%
Percent display (%)	0, 25, 50, 75, 100	±0.1	±0.20

Appendix 2 PARAMETERS OF BLOCKS

Main parameters are shown below.

Parameter		Setting prior to delivery	Description
Physical block			
TARGET_MODE		0x08 (Auto)	Target mode
MODE_BLK	PERMITTED	0x88 (O/S, Auto)	Permitted mode
	NORMAL	0x08 (Auto)	Normal mode
W_PROTECT		0xff (True)	
AI function block			
TARGET_MODE		0x08 (Auto)	Target mode
MODE_BLK	PERMITTED	0x88 (O/S, Auto)	Permitted mode
	NORMAL	0x08 (Auto)	Normal mode
PV_SCALE	EU100%	(Depends on device)	Set a range besed on initial unit
	EU0%		
OUT_SCALE	EU100%	(As specified)	Output scale
	EU0%		
	UNIT_INDEX		
	DECIMAL		
CHANNEL		1	Number of hard channel connected to transducer block
PV_FTIME		0	Damping time constant (sec)

Parameter		Setting prior to delivery	Description
Transducer block			
TARGET_MODE		0x08 (Auto)	Target mode
MODE_BLK	PERMITTED	0x88 (O/S, Auto)	Permitted mode
	NORMAL	0x08 (Auto)	Normal mode
CAL_POINT_HI		(Depends on device)	Calibration point high level
CAL_POINT_LO		(Depends on device)	Calibration point low level
SENSOR_UNIT			Calibration unit
PRIMARY_VALUE_TYPE		(As specified)	0: GP, DP 1: Flow 2: Level
BURNOUT_SET		(As specified)	0: Stick to high limit 1: Stick to low limit 239: Hold
CAL_DATA	COMMAND	0	129: Zero adjustment 130: Low-level adjustment 132: High-level adjustment
LOCAL_KEY		0	External adjustment screw 0: Enable 1: Disable
LCD_COMMAND		0	0: Unused 128: Write parameter 129: Write segment data
LCD_DISP	LCD_UPPER DISPLAY_VALUE	(As specified)	Display value at URV input
	LCD_LOWER_ DISPLAY_VALUE	(As specified)	Display value at LRV input
	LCD_DIGIT	(As specified)	Number of digits displayed below point
	LCD_UNIT	(As specified)	Display unit code (FCX-AⅡ unit code)

Appendix 3 UNIT CODES

The following shows typical examples of unit codes determined by the PROFIBUS-PA Profile. They are used for setting the unit of output scale.

Code	Unit	Code	Unit	Code	Unit
1130	Pa	1342	%	1518	kL/min
1132	MPa	1347	m^3/S	1519	kL/h
1133	kPa	1348	m^3/min	1541	Paa
1136	hPa	1349	m^3/h	1545	MPaa
1137	bar	1351	L/S	1546	MPag
1138	mbar	1352	L/min	1547	kPaa
1139	torr	1353	L/h	1548	kPag
1140	atm	1356	CFS	1557	kg/cm^2a
1141	Psi	1357	CFM	1558	kg/cm^2g
1142	Psia	1358	CFH	1559	inH_2Oa
1143	Psig	1362	gaL/S	1560	inH_2Og
1145	kg/cm^2	1363	GPM	1565	mmH_2Oa
1146	inH_2O	1364	gaL/h	1566	mmH_2Og
1149	mmH_2O	1371	bbℓ/S	1571	ftH_2Oa
1152	ftH_2O	1372	bbℓ/min	1572	ftH_2Og
1155	inHg	1373	bbℓ/h	1577	inHga
1157	mmHg	1450	kgaL/S	1578	inHgg
1322	kg/S	1451	MgaL/S	1581	mmHga
1323	kg/min	1454	kgaℓ/min	1582	mmHgg
1324	kg/h	1455	MgaL/min		
1326	t/S	1458	kgaℓ/h		
1327	t/min	1459	Mgaℓ/h		
1328	t/h	1485	kbbℓ/min		
1330	ℓb/S	1486	Mbbℓ/min		
1331	ℓb/min	1489	kbbℓ/h		
1332	ℓb/h	1490	Mbbℓ/h		

Appendix 4 HAZARDOUS LOCATION INSTALLATION INFORMATION

This appendix contains documents that present installation instruction for the FCX-AII Series Transmitter in a hazardous location. Refer to the figures or the instruction manual when installing or servicing a transmitter mounted in a hazardous location.
When installed, the apparatus must be provided with a voltage limiting device which will prevent the rated voltage of 32V being exceeded.

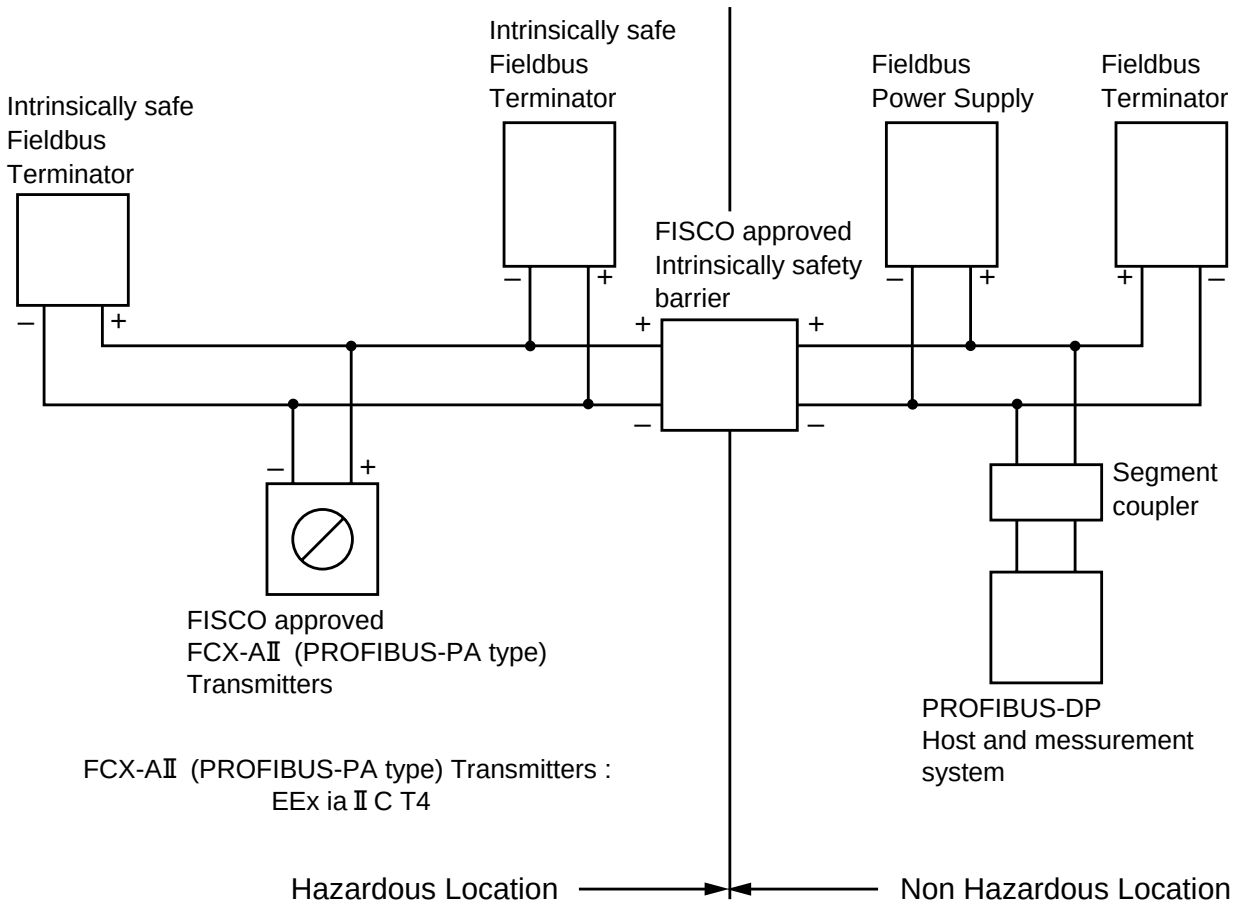


Fig. 1 FCX-AⅡ Series Transmitter, Typically PROFIBUS-PA Wiring Diagram for FISCO

EMC CONFORMITY OF FCX-AII

Emission lists:

EN 61326: 1997 Class A (Industrial location)

Frequency range	Limits	Reference standard
30 to 230 MHz	40 dB (μV/m) quasi peak, measured at 10 m distance	CISPR 16-1 and CISPR 16-2
230 to 1000 MHz	47 db (μV/m) quasi peak, measured at 10 m distance	CISPR 16-1 and CISPR 16-2

Immunity requirements:

EN 61326: 1997 Annex A (Industrial location)

Phenomenon	Test value	Basic standard	Performance
Electrostatic discharge	4 kV (Contact) 8 kV (Air)	EN 61000-4-2	B
Electromagnetic field	80 to 1000 MHz 10V/m 80% AM (1kHz)	EN 61000-4-3	A
Rated power frequency magnetic field	30 A/m 50Hz	EN 61000-4-8	A
Burst	2kV 5kHz	EN 61000-4-4	B
Surge	1.2/50μs 1kV-line to line 2kV-line to ground	EN 61000-4-5	B
Conducted RF	0.15 to 80 MHz 3V 80% AM (1kHz)	EN 61000-4-6	A

Definition of performance criteria:

A: During testing, normal performance within the specification limits.

B: During testing, temporary degradation, or loss of function or performance which is self-recovering.

Appendix 5 DISPLAY UNIT CODES

Unit	Code
MPa	15532033
kPa	786433
hPa	15859713
Pa	720897
bar	458753
mbar	524289
kg/cm^2	655361
g/cm^2	589825
mmH_2O	262145
cmH_2O	15925249
mH_2O	15728641
inH_2O	65537
ftH_2O	196609
mmHg	327681
cmHg	16515330
mHg	15794177
inHg	131073
psi	393217
atm	57345
torr	851969
mm	3211265
cm	3145729
m	2949121
in	3080193
ft	2883585
Nm^3/s	16520194
Nm^3/min	16520450
Nm^3/h	7929857
Nm^3/d	16520706
m^3/s	1835009
m^3/min	8585217

Unit	Code
m^3/h	1245185
m^3/d	1900545
l/s	1572865
l/min	1114113
l/h	9043969
l/d	16521218
Nl/s	16521474
Nl/min	16521730
Nl/h	7995393
Nl/d	16521986
gal/s	1441793
gal/min	1048577
gal/h	15400961
gal/d	15400961
ft^3/s	1703937
ft^3/min	983041
ft^3/h	8519681
ft^3/d	1769473
bbl/s	8650753
bbl/min	8716289
bbl/h	8781825
bbl/d	8847361
kg/s	4784129
kg/min	4849665
kg/h	4915201
kg/d	4980737
t/s	16520962
t/min	5046273
t/h	5111809
t/d	5177345
%	3735553
%SQRT	16527874

Appendix 6 CABLES FOR H1 FIELDBUS

As cables for H1 fieldbus, 4 types given in the table below are defined.

Cable type		Wire diameter	Total extension length
Type A cable	Pair of twisted wires with individual shields	0.8mm^2 #18AWG	1900m
Type B cable	Pair of twisted wires with batch shield	0.32mm^2 #22AWG	1200m
Type C cable	Pair of twisted wires without shield	0.13mm^2 #26AWG	400m
Type D cable	Untwisted wires	1.25mm^2 #16AWG	200m

Fuji Electric Systems Co., Ltd.

Head Office
Gate City Ohsaki, East Tower, 11-2, Osaki 1-chome,
Shinagawa-ku, Tokyo 141-0032, Japan
http://www.fesys.co.jp/eng

Instrumentation Div.
International Sales Dept.
No.1, Fuji-machi, Hino-city, Tokyo 191-8502, Japan
Phone: 81-42-585-6201, 6202 Fax: 81-42-585-6187
http://www.fic-net.jp/eng